Consultation on proposals to close fishing for sandeel in all Scottish waters

July 2023

Scottish Government
Riaghaltas na h-Alba

July 2023

Dear Sir/Madam

Consultation on proposals to close fishing for sandeel in all Scottish waters.

Given the importance of sandeel to the wider ecosystem and the subsequent benefit in aiding long-term sustainability and resilience of the marine environment, it remains an overarching Scottish Government position, which is reflected in Scotland's Fisheries Management Strategy, not to support fishing for sandeel in our waters. For this reason, the UK, supported by the Scottish Government, has not allocated sandeel quota since 2021.

There are several measures in place for the protection of sandeel stocks, through the network of Marine Protected Areas. Furthermore, a closure in sandeel management area 4 has been in place since 2000, for the purpose of avoiding bycatch of cod and haddock in the area, and to avoid negative impacts on the food supply for seabirds. The Scottish Government has responsibility for the part of the closed area which lies in Scottish waters.

Following the announcement by the Cabinet Secretary for Rural Affairs, Land Reform and Islands in May, the Scottish Government now wishes to consult on proposals to close fishing for sandeel in all Scottish waters to further ensure the sustainability of the sandeel stock, as well as providing wider ecosystem benefits. This letter seeks your views on this proposal.

All respondents should be aware of the guidance in Annex A, including on how we will handle your response and, complete the Respondent Information Form (RIF) in Annex B.

The deadline for responses is 13 October 2023

We look forward to hearing your views.

Marine Directorate

Contents

1. Introduction

The seas around Scotland have a wide variety of marine wildlife and varied habitats and support a diverse abundance of marine organisms. Sandeel form a particularly important component of the North Sea ecosystem and a link between different levels of the marine food chain[1] from plankton up to commercial fish species, seabirds, and marine mammals. As an island-based society, the sea around Scotland has always had an important role to play, offering a source of food and recreation.

The Scottish Government has national and international commitments to protect marine biodiversity, and to take necessary measures to protect and conserve the marine ecosystem. The Scottish Government is also committed to the sustainable management of fisheries, which includes taking account of the protection of biodiversity and healthy functioning ecosystems.

The Scottish Government has made the commitment under the Future Fisheries Management Strategy to work with stakeholders to deliver an ecosystem-based approach to management, including considering additional protections for spawning and juvenile congregation areas and restricting fishing activity or prohibiting fishing for species which are integral components of the marine food web, such as sandeel[2].

Marine protection needs to evolve to protect our marine ecosystem and manage activities that can impact on our ecosystem functions which are already responding to climate change.

Taking this into account, and following the Cabinet Secretary for Rural Affairs, Land Reform and Islands announcement in May 2023, the Scottish Government is now consulting on proposals to close fishing for sandeel in all Scottish waters. The consultation, which will seek views on these proposals, is being undertaken with the purpose of bringing about wider environmental and ecosystem benefits. These include potential benefits to sandeel, seabirds, marine mammals, and other fish species.

To inform this consultation a complementary document “Review of Scientific Evidence on the Potential Effects of Sandeel Fisheries Management on the Marine Environment” was produced by the Science, Evidence, Data and Digital Portfolio, Marine Directorate, Scottish Government. This report can be found along other supporting documents to this consultation.

1.1 Desired aims of the consultation

This document sets out the key issues that need to be considered in determining whether to close fishing for sandeel in all Scottish waters, subject to views received in response to this consultation. The Scottish Government wishes to consult on proposals to close fishing for sandeel in Scottish waters that meet as far as possible the following aims:

a) To seek effective protection of sandeel, as a contribution to the wider marine ecosystem.
b) To provide the opportunity for wider ecosystem benefits to a range of species, including commercial fish species, seabirds and marine mammals, that will also improve resilience to changes in the marine environment.
c) To complement, as far as possible, existing sandeel management measures.

[1] Sandeel | NatureScot
[2] Future fisheries: management strategy - 2020 to 2030 - gov.scot (www.gov.scot)

2. Proposals to close fishing for sandeel in all Scottish waters

2.1 Background

The Scottish Government has commitments under the UK Marine Strategy to collaborate with the other UK administrations to assess, monitor and publish a programme of measures the UK will use to support progress towards achieving Good Environmental Status (GES), this includes descriptors for biodiversity and commercial fish[3]. The Scottish Government's key regional platform for collaboration with neighbouring countries on marine biodiversity is OSPAR (the Convention for the Protection of the Marine Environment in the North-East Atlantic), where we participate as part of the UK and take action developed under this forum to protect and conserve the marine ecosystems and biodiversity.

Given the importance of sandeel to the wider ecosystem and the subsequent benefit provided by the species in aiding long-term sustainability and resilience of the marine environment, it remains an over-arching and long-held Scottish Government position not to support fishing for sandeel in Scottish waters, which is reflected in Scotland's Future Fisheries Management Strategy. This position was emphasised in June 2021 when the Cabinet Secretary for Rural Affairs and Islands committed in Parliament to considering what management measures could be put in place to better manage the North Sea sandeel fisheries in Scottish waters.

There are several measures in place for the protection of sandeel stocks including through the network of Marine Protected Areas (MPAs). Furthermore, a sandeel closure in sandeel management area 4 has been in place since 2000 and, the UK has not allocated sandeel quota to UK vessels since 2021.

In 2021, Scottish Government officials worked closely with UK counterparts on a call for evidence[4] to gather information to better inform our considerations on future management for sandeel. The Scottish Government is committed to considering how best to manage fishing for sandeel in Scottish waters, with the aim to benefit both North Sea sandeel stocks and the wider ecosystem, including sensitive marine species.

Sandeel are a key component of the ecosystem of Scotland's seas due to their role in marine food webs as a prey source for a range of species including seabirds, seals, cetaceans (e.g., whales, dolphins and porpoises), and predatory fish. Declines in sandeel abundance can negatively impact the survival and reproduction of ecologically important species.

2.2 Proposal for fisheries management measures for sandeel in Scottish waters

The Scottish Government has committed to considering what measures could be introduced to better manage fishing for sandeel in Scottish waters, with an aim to benefit both North Sea sandeel stocks, and the wider ecosystem.

The Scottish Government therefore wishes to consult on proposals to close fishing for sandeel in all Scottish waters. This proposal is informed by the potential benefits to the wider marine ecosystem that such measures could bring. These include benefits to sandeel,

[3] Marine strategy part one: UK updated assessment and Good Environmental Status - GOV.UK (www.gov.uk)
[4] Call for Evidence on future management of Sandeels and Norway pout - Defra - Citizen Space

seabirds, marine mammals, and other fish species[5]. The extension of the current closed area would also provide additional benefit to areas outside the Scottish MPA network and could contribute to progress towards achieving Good Environmental Status for seabirds and marine mammals[6].

These proposals have been informed by the current state of understanding of the role of sandeel in the ecosystem and the potential impacts that management measures could have and should be read alongside the "Review of Scientific Evidence on the Potential Effects of Sandeel Fisheries Management on the Marine Environment".

It is anticipated that any measures would be effective year-round and, would be introduced through the implementation of a Scottish statutory instrument applicable to all vessels that would otherwise fish within UK waters.

This proposal seeks to contribute to the following Marine Scotland Blue Economy Outcomes[7]:

Environment: Scotland's marine ecosystems are healthy and functioning, with nature protected and activities managed using an ecosystem-based approach to ensure negative impacts on marine ecosystems are minimised and, where possible, reversed.
This proposal seeks to contribute to the following National Outcomes[8]:

Environment: We value, enjoy, protect and enhance our environment.

Economy: We have a globally competitive, entrepreneurial, inclusive and sustainable economy

3. Current sandeel management

Sandeel is a jointly managed stock between the UK and the EU (European Union). Under the UK/EU trade and cooperation agreement (TCA), the UK has a 2.97% share and the EU a 97.03% share of the parties' combined sandeel quota in 2023. Additionally, the Total Allowable Catch (TAC) is set during in-year annual consultations, following the publication of ICES advice . As a result of the negotiations this year, the TAC has been set at 194,367 tonnes[9] which is 3% lower for areas 1r and 4[10] (UK waters) than the ICES advice.

Under the TCA and during a transition period lasting until 30 June 2026, the UK and the EU have full mutual access to their respective exclusive economic zones (EEZs) (i.e. waters adjacent from 12 – 200 nautical miles); as well as access to specific English, Welsh and Channel Island waters in the 6-12 nautical mile area. Sandeel is an important fishery to some EU member states, in particular Denmark, who regularly fish the stock in UK waters in May and June.

[5] Review of Scientific Evidence on the Potential Effects of Sandeel Fisheries Management on the Marine Environment (2023); Science, Evidence and Data Portfolio, Marine Directorate, Scottish Government
[6] updated UK Marine Strategy Part Two (publishing.service.gov.uk)
[7] 6. The Six Outcomes - A Blue Economy Vision for Scotland - gov.scot (www.gov.scot)
[8] National Outcomes | National Performance Framework
[9] European Union and the United Kingdom – sandeel fisheries consultations: written record for 2023 - gov.scot (www.gov.scot)
[10] Sandeel (Ammodytes spp.) in divisions 4.b–c, Sandeel Area 1r (central and southern North Sea, Dogger Bank) (figshare.com)

3.1 Sandeel fishery in UK waters and UK quota allocation

Sandeel fishing in UK waters is currently assessed and managed in the North Sea, where it supports one of the largest single-species industrial fishery. The fishery is highly seasonal, taking place mostly in the spring and summer of each year.

Sandeel are targeted by highly specific gears and are processed for their oil and fish meal for use in many types of food for human and animal consumption. Denmark, Norway, Sweden, the UK, and Germany historically participate in the sandeel fishery.

However, it remains an over-arching and long-held Scottish Government position not to support fishing for sandeel in Scottish waters, which is reflected in Scotland's Future Fisheries Management Strategy. As such, since 2021 sandeel quota has not been allocated to UK vessels.

Historically, the stock has been targeted (primarily) by one UK vessel. A major sandeel fishing area in the North Sea has also been closed to UK and EU vessels since 2000, except for a limited monitoring fishery in some years. The total landings by all UK vessels between 2016-2022 are presented in the Table 1.

Table 1. Sandeel catches by the UK vessels between 2016-2022 (Source: Marine Analytical Unit 5 April 2023).

Year	**2016***	**2017**	**2018**	**2019**	**2020**	**2021***	**2022***
Sandeel catch (tonnes)	20.9	3,330.8	1,863.2	1,068.5	3,901.4	3.7	3.1

*Monitoring fishery

3.2 Current area closure for sandeel

There is a sandeel closure currently in place in sandeel management area 4 (Figure 1). This area extends along most of the east coast of Scotland, as well as some of the northeast coast of England, and is exclusively within UK waters. Figure 1 also shows three Nature Conservation Marine Protected Areas (NC MPAs), which are the 'Turbot Bank', 'North west Orkney' and 'Mousa to Boddam'.

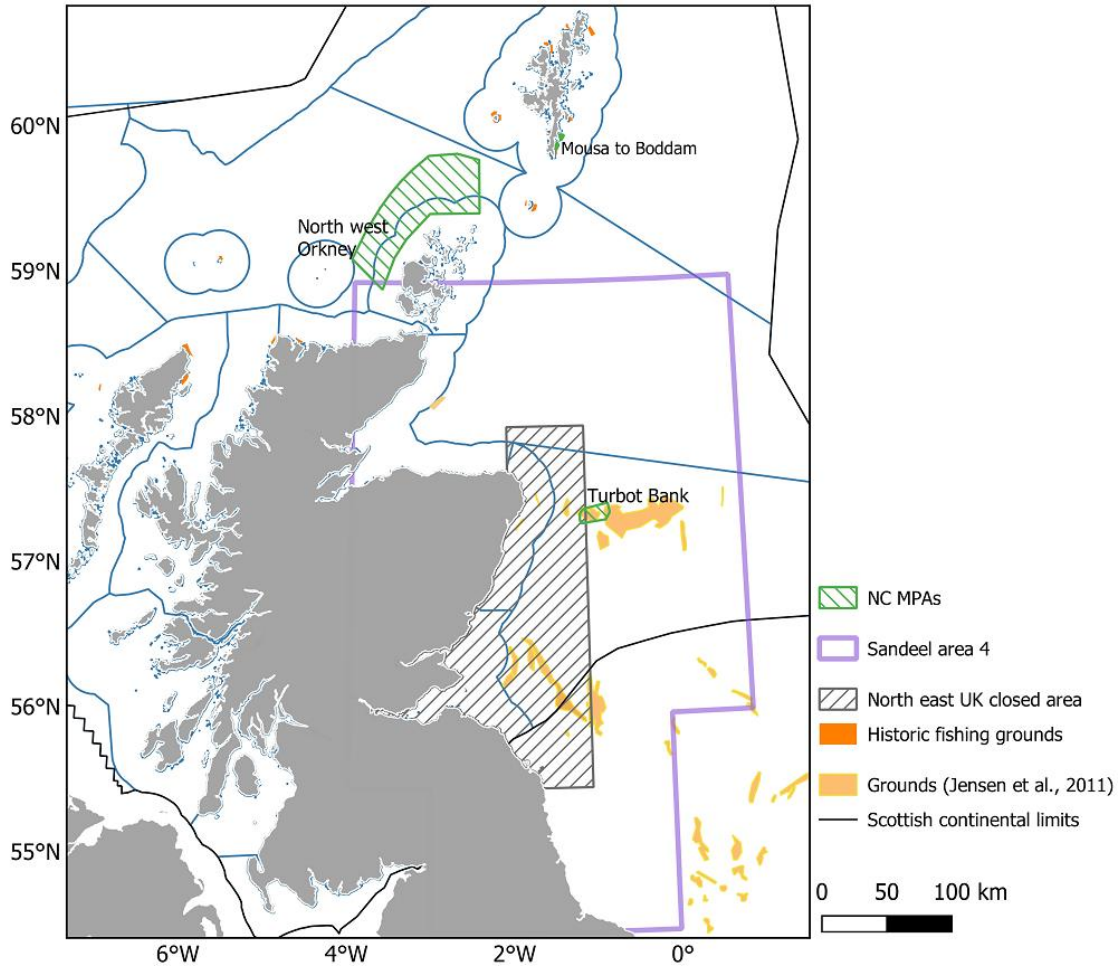

Figure 1. The existing northeast UK area closed to sandeel fisheries and the various spatial management measures for sandeel within Scottish waters. (Reproduced from a Case Study: Sandeels in Scottish Waters)

The fishery closure of an area to protect sandeel in ICES divisions 4a and 4b was included in EU regulations, and has been retained in UK law:

Fishing for sandeel with any towed gear with a codend mesh size less than 32 mm shall be prohibited within the geographical area bounded by the east coast of England and Scotland, and enclosed by sequentially joining with rhumb lines the following coordinates, which shall be measured according to the WGS84 system:

— the east coast of England at latitude 55°30′ N
— 55°30′ N, 01°00′ W
— 58°00′ N, 01°00′ W
— 58°00′ N, 02°00′ W
— the east coast of Scotland at longitude 02°00′ W.

Fisheries for scientific investigation shall be allowed in order to monitor the sandeel stock in the area and the effects of the closure[11].

[11] Regulation (EU) 2019/1241 of the European Parliament and of the Council, Part C: Closed or Restricted Areas.

The closure was intended to benefit predators dependent on sandeel by avoiding a localised sandeel depletion. Seabirds were the focus of this, however all sandeel predators were considered[12].

The fishery closed area has been in place since 2000, following requests from the UK to the EU to establish a moratorium on fishing and advice from ICES, which stressed the importance of sandeel for several potential sensitive seabird colonies in the area[13].

The two main scientific justifications for the closure implemented in 2000 were:

a) to avoid bycatches of cod and haddock in the area, and;
b) to avoid negative impacts on the food supply for seabirds. The 2020 Herring Assessment Working Group (HAWG) report refers directly to the effect of sandeel fisheries on seabirds:

> Page 43 - Sandeel play in fact an important role in the North Sea foodweb as they are a high quality, lipid rich food resource for many predatory fish, seabirds and marine mammals. Concerns of local depletion exist, especially for those sandeel aggregations occurring at less than 100 km from seabird colonies as some bird species (i.e., black-legged kittiwake and sandwich tern) may be particularly affected whereas more mobile marine mammals and fish are likely to be less vulnerable to local sandeel depletion.
>
> Page 783 - In the light of studies linking low sandeel availability to poor breeding success of kittiwake, there has been a moratorium on sandeel fisheries on Firth of Forth area along the UK coast since 2000. Note that a limited fishery for stock monitoring purposes occurs in May–June in this area[14].

The current area closure, which has been retained in UK law, allows for "fisheries for scientific investigation." In recent years, Denmark have requested and received this authorisation, and have therefore fished in the area for scientific investigation only.

3.3 Marine Protected Areas (MPAs)

In addition to the northeast UK closed area, which covers 30.2% of sandeel area 4, the Scottish Government has made major steps in protecting areas of key importance to sandeel through the designation of a network of MPAs focussed on areas important to sandeel populations.

Sandeel is a protected feature of the following MPAs - Mousa to Boddam MPA, North-west Orkney MPA, and Turbot Bank MPA[15]. Several MPAs also aim to conserve sandeel habitat to ensure the continued supply of young recruits to other sandeel grounds across Scotland and the rest of the UK.

Sandeel are also a Priority Marine Feature (PMF)[16] due to their ecosystem importance. Scottish Ministers adopted a list of 81 PMFs, which listed of a variety of species and habitats that are considered important components of the biodiversity of Scottish seas. The National Marine Plan requires that development and use of the marine environment must no result in significant impact on the national status of PMFs.

[12] Microsoft Word - SGMOS-07-03 report v3 with STECF opinion.doc (europa.eu)
[13] Case Study: Sandeels in Scottish waters | Scotland's Marine Assessment 2020
[14] Herring Assessment Working Group for the area South of 62° N (HAWG) (figshare.com)
[15] Sandeel | NatureScot
[16] Priority Marine Features - Marine environment - gov.scot (www.gov.scot)

4. Sandeel

Sandeel are part of the *Ammodytidae* family, consisting of small eel-like fishes, and represent the most abundant fish species in the North Sea playing a key role in North Atlantic marine food webs. Variations in the abundance and availability of sandeel or other forage fish can have important effects on both ends of marine food web (top-down regulation of lower trophic levels and bottom-up effects on marine predators) and disrupt the energy transfer across the whole food-web[17].

Sandeel in the North Atlantic and the North Sea refers to a complex of species of which the most abundant is the lesser sandeel (*Ammodytes marinus*), which supports one of the largest single-species fishery in the North Sea. The lesser sandeel is a winter-spawning species which lay eggs on the sand in winter months, with planktonic larvae occupying the water column from hatching in February - April to settlement in May - June. Settlement marks a key transition in the sandeel life cycle, after which they form pelagic feeding schools during the day, burying into the sand at night. Following the summer feeding season, sandeel remain in the sand day and night for the overwintering period, apart from a short spawning period in December - January, until emergence from the sand the following spring. These aspects of sandeel life cycle, particularly this life-long attachment to a sand bank, are important determinants of their distribution.

Sandeel are distributed broadly in Scottish waters where they are highly reliant upon the availability of suitable sandy substrates[18] [19] [20] [21]. Langton *et al*. (2021) provides a prediction of sandeel distributions within and beyond the limits of Scottish waters (Figure 2). This predicts the highest probability of sandeel occurrence on Dogger Bank and identifies sandeel grounds in the Firth of Forth (consistent with historic sandeel fishing grounds), the Moray Firth, the east coast of Orkney, east of Dublin, northeast coast of Donegal, north and west of Islay, and to the north and west of Lewis. Model predictions were validated against the east coast sandeel dredge survey and both the North Sea and West of Scotland International Bottom Trawl Surveys.

Climate change acting through an increase of sea temperature, ocean acidification, a decrease in oxygen levels and their cumulative effects can also affect sandeel abundance through direct effects on survival and physiological rates, including phenology (the timing of key life-stages). Direct effects on the phenology of both sandeel and their copepod prey can lead to indirect effects of climate change on sandeel abundance through trophic

[17] Lynam, C. P., Llope, M., Möllmann, C., Helaouët, P., Bayliss-Brown, G. A., & Stenseth, N. C. (2017). Interaction between top-down and bottom-up control in marine food webs. Proceedings of the National Academy of Sciences of the United States of America, 114(8), 1952–1957. https://doi.org/10.1073/pnas.1621037114

[18] Olin A.B., Banas N.S., Wright P.J., Heath M.R. & Nager R.G (2020) Spatial synchrony of breeding success in the blacklegged kittiwake Rissa tridactyla reflects the spatial dynamics of its sandeel prey. Mar Ecol Prog Ser 638:177-190. https://doi.org/10.3354/meps13252

[19] Holland, G.J., Greenstreet, S.P., Gibb, I.M., Fraser, H.M. & Robertson, M.R., 2005. Identifying sandeel Ammodytes marinus sediment habitat preferences in the marine environment. Marine Ecology Progress Series, 303, pp.269-282.

[20] Tien N.S.H., Craeymeersch J., van Damme C., Couperus A.S., Adema J. &Tulp I. (2017) Burrow distribution of three sandeel species relates to beam trawl fishing, sediment composition and water velocity, in Dutch coastal waters. J. Sea Res. 127: 194–202.

[21] Langton R., Boulcott P., Wright P.J. (2021) A verified distribution model for the lesser sandeel Ammodytes marinus. Mar. Ecol. Prog. Ser. 667: 145-159.

mismatch[22] [23]. High fishing mortality is often associated with the selective removal of older and larger fish and evidence show that these fish tend to spawn earlier. Limiting or closing the sandeel fishery may therefore improve sandeel resilience to the seasonal variation in prey availability.

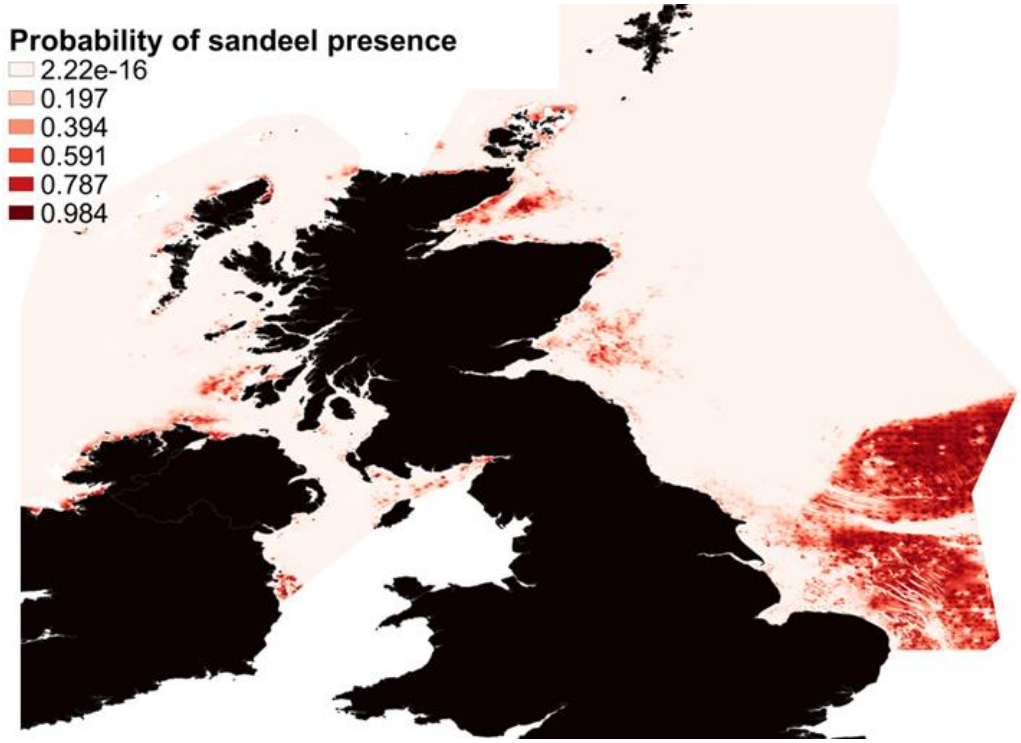

Figure 2. Predicted probability of occurrence of sandeel in UK waters. Reproduced from Langton et al. 2021.

4.1 Potential effects of fishery closure on sandeel

Causes of variation in sandeel abundance are numerous and are driven by fishing mortality and (principally) natural mortality, the latter being influenced by factors such as environmental change (temperature effects, regime shifts) and top-down processes (trophic regulation by marine predators). Evidence shows that causes of variation in natural mortality can play a more prominent role than fishing mortality in shaping sandeel abundance in Scottish waters and as these causes of variation are rarely accounted for, an effect of fishing pressure on sandeel abundance may be rarely observed. However, while results should be considered with caution, age 1 sandeel seem to have a higher survival rate in the current fishery closure[24].

While the effect of a fishery closure may be difficult to observe in a changing environment, sandeel is likely to benefit from spatial management measures aimed at reducing fishing mortality due to their life-long attachment to specific sand banks and limited dispersal and movements. A fishery closure may promote sandeel resilience to climate change by limiting variation in Spawning Stock Biomass (SSB) that might affect recruitment and ensuring that

[22] Regnier, T., Gibb, F.M. & Wright, P.J. (2017) Importance of trophic mismatch in a winter- hatching species: evidence from lesser sandeel. Mar. Ecol. Prog. Ser. 567:185-197.
[23] Regnier, T., Gibb, F.M. &Wright, P.J. (2019) Understanding temperature effects on recruitment in the context of trophic mismatch. Sci. Rep. 9: 15179.
[24] Review of Scientific Evidence on the Potential Effects of Sandeel Fisheries Management on the Marine Environment.(2023)Science, Evidence and Data Portfolio, Marine Directorate, Scottish Government .pp 85.

sufficient large, early spawning individuals are present in the population. In accordance, a modelling study found that population collapse was more likely under exploitation[25].

Furthermore, a reduction of fishing mortality could promote resilience in local sandeel populations by providing a buffer against an increase in predation mortality should predator stocks increase in abundance (for example recent positive stock trends for whiting and haddock).

5. Sandeel and their role in the marine ecosystem

5.1 Background

Sandeel represent the most abundant and important forage fish in the North Sea and play a key role in North Atlantic marine food webs[26]. Variations in the abundance and availability of sandeel or other forage fish can have important effects on both ends of the marine food web (top-down regulation of lower trophic levels and bottom-up effects on marine predators such as mammals, seabirds and predatory fish).

The total stock biomass of sandeel has shown an overall decline over the last three decades. Climate change has the potential to further affect sandeel abundance and their availability to marine predators. Reduced pressure from industrial fishing could provide benefits through increasing the resilience of sandeel to other environmental pressures.

5.2 Predatory fish

Sandeel is a prey species for some whitefish species (e.g., cod, whiting, haddock). Initial analyses of fish stomach contents (ICES 1997) concluded that sandeel constituted up to 20% of age 1 cod diet in July-September and between 5-10% of the diet in other age classes in April to September, when sandeel actively feed. In haddock, sandeel constituted >50% of age 0 fish in April to June and between 40-50% of the diet for all other age classes in July to September. In whiting, sandeel composed around 45% of the diet of all age classes in April to June and decreased to around 20% in July to September. Whiting body condition was found to be correlated with the amount of sandeel present in their stomachs[27] and their spatial distribution was found to be influenced by sandeel, with whiting found to aggregate near sandeel-rich areas[28] [29]. Furthermore, the amount of sandeel consumed by predators will also depend on predator stock abundance and their spatial distribution.

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[25] Poloczanska, E.S., Cook, R.M., Ruxton, G.D. and Wright, P.J. (2004) Fishing vs. natural recruitment variation in sandeel as a cause of seabird breeding failure at Shetland: a modelling approach. ICES J. Mar. Sci. 61: 788–797.

[26] estimate of the total biomass of fish in the North Sea | ICES Journal of Marine Science | Oxford Academic (oup.com)

[27] Engelhard, G.H., Peck, M.A., Rindorf, A., Smout, S.C., van Deaurs, M., Raab, K., Anderson, K.H., Garthe, S., Lauerburg, R.A.M., Scott, F., Brunel, T., Aarts, G., van Kooten, T. & Dickey-Collas, M. (2014), Forage fish, their fisheries, and their predators: who drives whom?, ICES Journal of Marine Science, Volume 71, Issue 1, January 2014, Pages 90–104 https://doi.org/10.1093/icesjms/fst087

[28] Predation of whiting and haddock on sandeel: aggregative response, competition and diel periodicity - Temming - 2004 - Journal of Fish Biology - Wiley Online Library

[29] Engelhard, G., van der Kooij, J., Bell, E., Pinnegar, J., Blanchard, J., Mackinson, S., & Righton D. (2008) Fishing mortality versus natural predation on diurnally migrating sandeel Ammodytes marinus. Mar. Ecol. Progr. Ser. 369: 213-277.

5.2.1 Cod

Atlantic cod *(Gadus morhua)* is considered as a sandeel reliant fish as reported in ICES (1997) and is distributed broadly across North Atlantic waters. In Scottish waters significant aggregations are found off the Moray Firth, the Northern Isles as well as areas off Rattray head and Buchan Deep [30]. An estimation of the distribution of cod spawning grounds highlights the presence of several recurrent and occasional cod spawning grounds in Scottish waters (Figure 3).

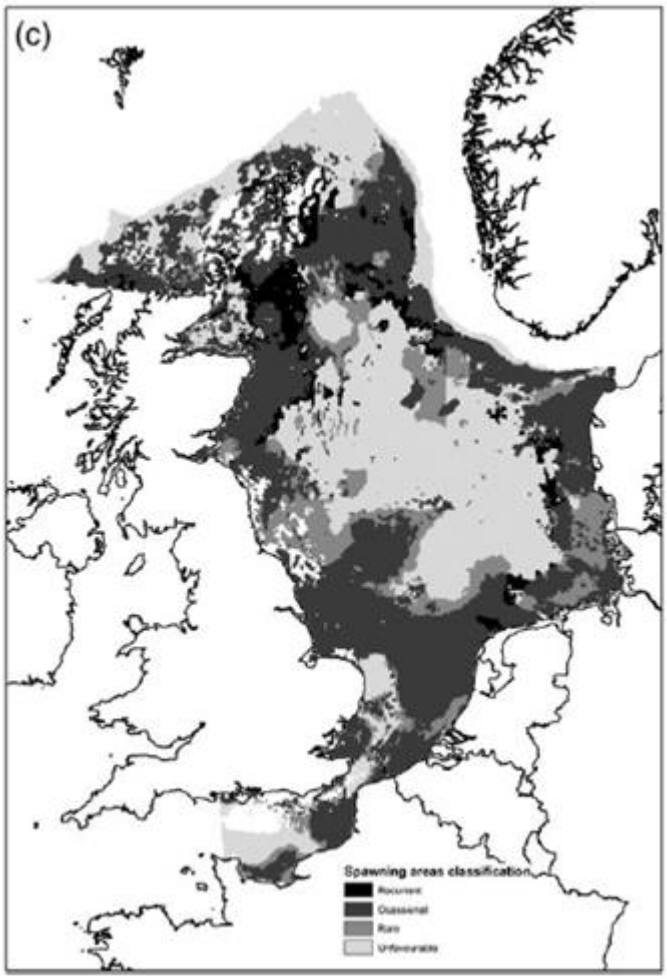


Figure 3: Classification of cod spawning habitat by recurrence[31].

5.2.2. Haddock

Haddock *(Melanogrammus aeglefinus)* is considered as a sandeel reliant fish as reported in ICES (1997) and is distributed broadly across North Atlantic waters. In Scottish waters, significant aggregations are found off the Moray Firth and along the East coast of Scotland and to the West of the Hebrides particularly for age 5 and older [32]. An estimation of the distribution of haddock spawning grounds highlights the presence of a number of recurrent and occasional haddock spawning grounds in Scottish waters (Figure 4).

[30] ICES. 2022. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK).ICES Scientific Reports. 4:43. 1367 pp. http://doi.org/10.17895/ices.pub.19786285
[31] Gonzalez-Irusta, J. M., and Wright, P. J. (2016a) Spawning grounds of Atlantic cod (Gadus morhua) in the North Sea. – ICES Journal of Marine Science, doi: 10.1093/icesjms/fsv180.
[32] ICES. 2022. Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK).ICES Scientific Reports. 4:43. 1367 pp.

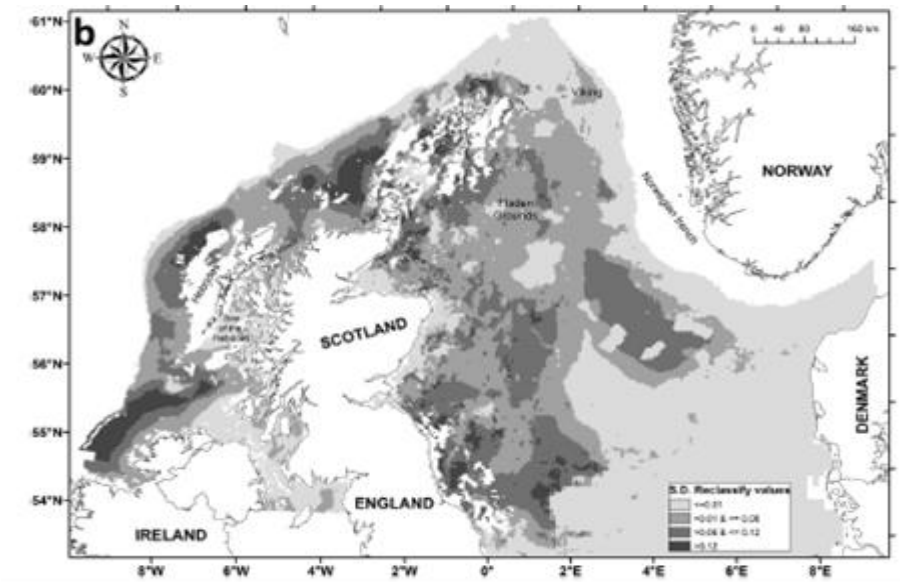
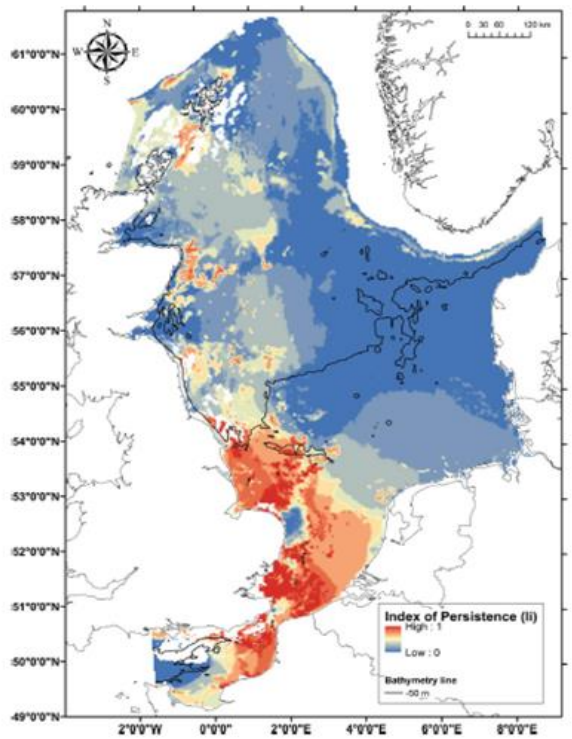


Figure 4: Classification of haddock spawning by recurrence[33]

5.2.3 Whiting

Whiting *(Merlangius merlangus)* is considered as a sandeel reliant fish as reported in ICES (1997) and is predominantly found in the North Sea. In Scottish waters, significant aggregations are found off the Moray Firth and along the East coast of Scotland. An estimation of the distribution of whiting spawning grounds highlights the presence of a number of persistent and occasional whiting spawning grounds in Scottish waters, particularly around the Northern Isles and off the East coast of Scotland (Figure 5).



[33] Gonzalez-Irusta, J. M., and Wright, P. J. (2016b) Spawning grounds of haddock (Melanogrammus aeglefinus) in the North Sea and West of Scotland. Fisheries Research. 183. 180-191. 10.1016/j.fishres.2016.05.028.

Figure 5: Classification of whiting spawning habitat by recurrence[34].
Predatory fish are often generalist feeders, switching between prey species based on availability[35]. The importance of sandeel as a food source is more variable for predatory fish than for seabirds and mammals [36]. Some fish species such as whiting, haddock, cod, plaice, lesser weever, and grey gurnard have shown higher body condition indices or growth in years of high sandeel abundances [37] [38]. Body condition relates to growth, survival and reproduction and can thereby affect fitness and abundance of these predators.

However, complex environmental interactions, including dynamics in predatory fish populations, competition for food sources, cannibalism and climate change may also affect the abundance of sandeel in the North Sea, making prediction of sandeel stock development following a fishery closure difficult[39] [40] [41] [42] [43] [44] [45].

5.3 Seabirds

Scotland supports internationally important populations of breeding seabirds, with 24 species regularly breeding in Scotland[46]. However, in recent decades many seabird populations have suffered substantial declines, with seabirds in the Greater North Sea not achieving GES in the most recent UK Marine Strategy assessment[47].

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[34] González-Irusta, J. M., and Wright, P. J. (2017). Spawning grounds of whiting (Merlangius merlangus). Fisheries Research. 195. 141-151. 10.1016/j.fishres.2017.07.005.
[35] Engelhard, G.H., Peck, M.A., Rindorf, A., Smout, S.C., van Deaurs, M., Raab, K., Anderson, K.H., Garthe, S., Lauerburg, R.A.M., Scott, F., Brunel, T., Aarts, G., van Kooten, T. & Dickey-Collas, M. (2014), Forage fish, their fisheries, and their predators: who drives whom?, ICES Journal of Marine Science, Volume 71, Issue 1, January 2014, Pages 90–104 https://doi.org/10.1093/icesjms/fst087
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[47] Marine Strategy Part One: UK updated assessment and Good Environmental Status (publishing.service.gov.uk) page 53.

A large proportion of seabird species in Scotland include sandeel in their diet during the breeding season, although the extent to which seabirds are dependent on sandeel varies across species, with gannet (*Morus bassanus)* identified as having low sensitivity to sandeel abundance and kittiwake (*Rissa tridactyla)* high sensitivity.

During breeding, many Scottish seabird populations exploit seasonal peaks in sandeel abundance, feeding on both adults (1+ age group) and juveniles (young-of-the-year; age 0). For example, on the Isle of May, Firth of Forth, sandeel comprised approximately 75% of the breeding season diet of shag *(Phalacrocorax aristotelis),* kittiwake and puffin (*Fratercula arctica)* between 1991 and 2011[48] . Sandeel also constituted a substantial proportion of the diet of seabirds breeding on Canna, Western Isles between 1981–2007. Over this period sandeel were the greatest component (62%) of regurgitations from young shag and adults feeding chicks, comprised a quarter of young guillemot *(Uria aalge)* diet, and occurred in 60% of kittiwake regurgitations, being the commonest fish family in 14 of the 20 years in this latter seabird species' diet[49].

The ability of seabirds to prey on sandeel will depend on both the absolute numbers of sandeel (stock biomass) and the availability of sandeel to seabirds. However, understanding the extent to which seabird demography (breeding success, survival, and population size) is determined by sandeel abundance and availability to seabirds, and hence the potential benefits that a sandeel fishery closure might bring for seabirds, is not straightforward.

A consistent pattern in the way seabird breeding success changes with forage fish abundance has been reported for many seabird-forage fish interactions around the globe. Known as 'one-third for birds', studies found that seabird breeding success vary little or not at all at intermediate and high forage fish abundance, but once forage fish abundance dropped below a threshold of one-third of maximum biomass, seabird breeding success rapidly declined[50]. This relationship has also been found for seabirds feeding on sandeel, e.g., for breeding success of Arctic skua (*Stercorarius parasiticus*, great skua (*Stercorarius skua)* and kittiwake on Foula in relation to the Shetland sandeel total stock biomass[51] A similar relationship has also been found for a proxy of adult survival at the Isle of May for kittiwakes[52].

Seabird breeding success is also influenced by the availability of prey. Seabirds are constrained in the distance from nest sites that they can forage (when breeding) and the depth in the water column that they can reach. Prey therefore needs to be within foraging range and within dive depth; both of which vary among seabird species. Similarly, prey of the

[48] Newell, M., Harris, M.P., Burthe, S., Wanless, S. & Daunt, F. (2013) Isle of May seabird studies in 2011 JNCC Report, No. 475g Isle of May seabird studies in 2011 (jncc.gov.uk)

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[50] Cury, P.M., Boyd, I.L., Bonhommeau, S., Anker-Nilssen, T., Crawford, R.J.M., Furness, R.W., Mills, J.A., Murphy, E.J., Österblom H., Paleczny, M., Piatt, P.F., Roux, J.-P., Shannon, L. & Sydeman, W.J. (2011). Global seabird response to forage fish depletion – one-third for the birds. Science 334: 1703–1706.

[51] Frederiksen, Morten & Furness, Robert & Wanless, Sarah. (2007). Regional variation in the role of bottom-up processes in controlling sandeel abundance in the North Sea. Marine Ecology Progress Series. 337. 279-286. 10.3354/meps337279.

[52] MacArthur Green (2021) HRA Derogation Scope B - Review of seabird strategic compensation options. Report to Crown Estate Scotland and SOWEC.

right age or size class must be available at the right time of year for provisioning to chicks. For example, kittiwake tend to feed on age 1+ sandeel in April and May, shifting to age 0 sandeel in June and July, with highest breeding success occurring when age 0 sandeel appeared early in the season. To be of most benefit to seabirds, the peak in sandeel abundance needs to coincide with the seabird chick rearing phase of the seabird breeding season. However, the timing of sandeel availability and absolute abundance shows inter-annual variation, which can result in a mismatch between peak sandeel availability and seabird chick rearing and negative effects on seabird productivity. Some seabird species are more able to switch prey species than others, for example guillemot switch prey species more easily than kittiwake, which may help mitigate some of the negative effects of reduced or mismatched sandeel availability.

Establishing a relationship between industrial sandeel fisheries and seabird demography is challenging. Fishing mortality is only one factor influencing sandeel stock biomass, with natural predation by other fish, marine mammals and seabirds, copepod prey abundance, and wider environmental conditions key factors. Furthermore, lag effects between seabird demography and environmental conditions can increase complexity and uncertainty.

On two occasions sandeel fisheries have been closed due to concerns about their impacts on the breeding success of seabirds: the small sandeel fishery off Shetland in the 1990s and the Wee Bankie, Scalp Bank and Marr Bank fishery off south east Scotland in 2000. Kittiwake showed a statistically significant decrease in breeding success attributable to the south east of Scotland sandeel fishery (from 52% to 23% proportion of nests to young fledged), followed by a smaller but still statistically significant increase in breeding success (10%) when the fishery closed, compared with control colonies. Puffin, razorbill *(Alca torda),* and guillemot showed no negative effects of the fishery on breeding success, nor any positive effects following closure[53].

The positive benefits to seabird productivity and populations of a sandeel fishery closure are difficult to quantify because of the complex relationships between prey and seabird demography, ongoing climate-mediated changes in sandeel population (including from climate change) and the numerous other pressures that seabirds face (e.g., habitat loss, biosecurity, infectious disease (such as Highly Pathogenic Avian Influenza[54]), climate change, storm events[55], human disturbance to breeding birds[56] and predation of both chicks and adult seabirds[57]). There is also considerable variation across seabird species in their dependence upon sandeel and their ability to switch to alternative prey. However, despite these uncertainties, maximising abundance and availability of sandeel stocks as prey for seabirds in Scotland (by way of removing potential pressure from industrial fishing) remains a key mechanism by which resilience in seabird populations might be achieved.

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[54] Avian flu task force announced | NatureScot

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[56] Effects of a fishery closure and prey abundance on seabird diet and breeding success: Implications for strategic fisheries management and seabird conservation - ScienceDirect

[57] Top-down control of a marine mesopredator: Increase in native white-tailed eagles accelerates the extinction of an endangered seabird population - Anker-Nilssen - 2023 - Journal of Applied Ecology - Wiley Online Library

5.4 Marine mammals

Sandeel are a key prey species for marine mammals in Scottish waters, comprising a large proportion of the diet of seals and some cetaceans[58] [59], although the importance of sandeel to marine mammal diet varies with species and season.

5.4.1 Seals

Grey seals (*Halichoerus grypus)* and harbour seals (*Phoca vitulina)* occur widely throughout Scottish and UK waters (Figures 6) and largely occur within the same ecological niches with some degree of regional spatial partitioning. This is marked by a notable overlap in diet throughout the UK populations where sandeel and large gadids are proportionally the most represented prey groups by weight, in both species [60] [61] [62] [63] [64] [65]. The at sea distribution of both harbour and grey seals overlaps with predicted sandeel habitat in UK waters (Figure 3).

Diet analysis studies have concluded that sandeel dominate the diet of grey seals in all regions during autumn and winter except for the Inner Hebrides where gadids predominated [66]. However, this dominance shifts to gadids and other benthic species during the spring and summer in Orkney and Shetland and drops from 22.2% to 8% of the diet of grey seals in the Inner Hebrides. For harbour seals, sandeel were also dominant but with regional variation, with sandeel dominant in harbour seal scats in the Moray Firth across all seasons, although sandeel became less important in more southerly regions with flatfish and gadids predominating in south-east Scotland, the southern North Sea and the Inner Hebrides. In addition, harbour seals from the Outer Hebrides and Shetland preferred pelagic species with sandeel only representing 13.1% and 23.7% of the diet in these regions during the spring and summer months. This prevalence does increase during autumn and winter in Shetland

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[59] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

[60] Brown, E. G., Pierce, G. J., Hislop, J. R., & Santos, M. B. (2001). Interannual variation in the summer diets of harbour seals Phoca vitulina at Mousa, Shetland (UK). Journal of the Marine Biological Association of the United Kingdom, 81(2), 325-337.

[61] Hall, A. J., Watkins, J., & Hammond, P. S. (1998). Seasonal variation in the diet of harbour seals in the south-western North Sea. Marine Ecology Progress Series, 170, 269-281.

[62] Santos, M.B. & Pierce, G.J. (2003). The diet of harbour porpoise (Phocoena phocoena) in the northeast Atlantic. Oceanography and Marine Biology: an Annual Review 41: 355-390.

[63] Sharples, R. J., Arrizabalaga, B., & Hammond, P. S. (2009). Seals, sandeels and salmon: diet of harbour seals in St. Andrews Bay and the Tay Estuary, southeast Scotland. Marine Ecology Progress Series, 390, 265-276.

[64] Tollit, D. J. & Thompson, P. M. (1996). Seasonal and between-year variations in the diet of harbour seals in the Moray Firth, Scotland. Canadian Journal of Zoology, 74, 1110-1121.

[65] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

[66] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

where sandeel become the preferred prey of harbour seals, representing 31.5% of their diet[67].

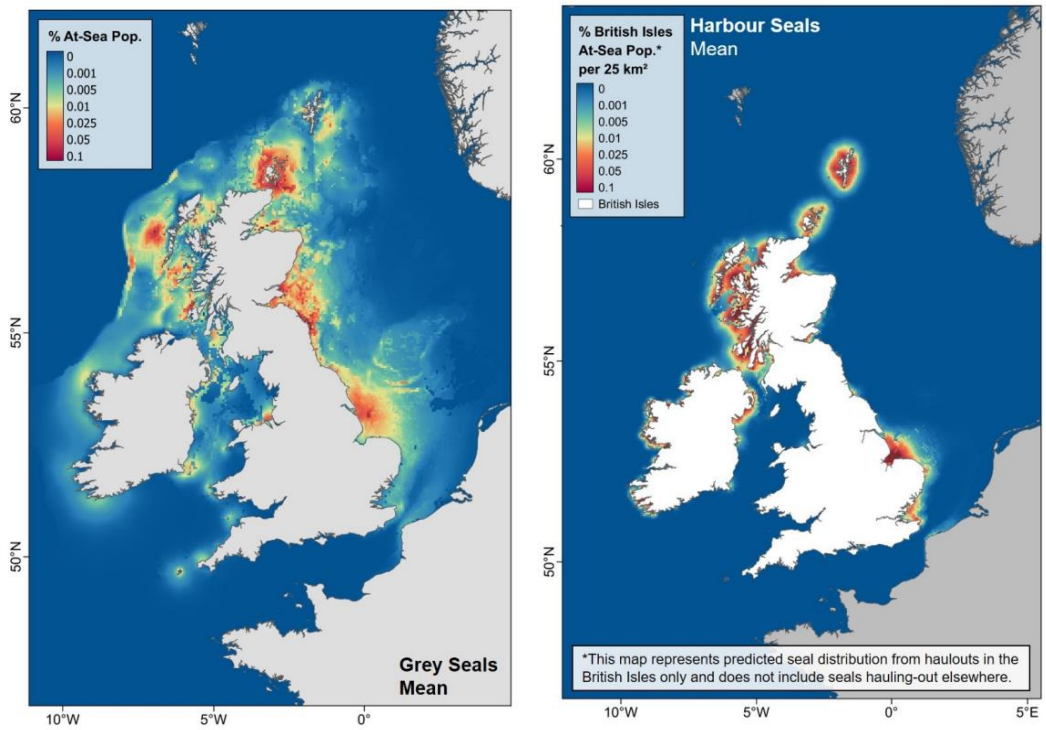

Figure 6. Predicted at-sea density of grey seal (left) and harbour seal (right)[68].

While grey seal populations down the east coast of the UK continue to increase, harbour seals are experiencing regional population declines (e.g., north and east coast of Scotland) resulting in harbour seals not achieving Good Environmental Status in the Greater North Sea[69]. Studies suggested that the decline in harbour seal abundance in the North Sea may be linked to a reduction in sandeel stocks. Specifically, there appears to be a correlation between regional declines of sandeel stocks (northern and eastern Scotland) and the declining populations of harbour seals in eastern Scotland and Orkney, where sandeel dominate the diet of harbour seals. This relationship with sandeel stock levels was supported by findings that the diet of harbour seals appeared more diverse in areas where harbour seals are not in decline. If sandeel are in short supply, it could be that grey seals may out compete harbour seals thereby contributing to their decline given grey seal preference for sandeel in these regions[70].

5.4.2 Cetaceans

[67] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

[68] Carter, M.I.D., Boehme, L., Duck, C.D., Grecian, W.J., Hastie, G.D., McConnell, B. J., Miller, D.L., Morris, C.D., Moss, S.E.W., Thompson, D., Thompson, P.M. & Russell, D.J.F. (2020). Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles. Sea Mammal Research Unit, University of St Andrews, Report to BEIS, OESEA-16-76/OESEA-17-78.

[69] updated UK Marine Strategy Part Two (publishing.service.gov.uk)

[70] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

Scottish waters support a diverse range of cetaceans[71] with sandeel and other forage fish forming an important part of the diet of many of these species including minke whale (*Balaenoptera acutorostrata*)[72] and harbour porpoise (*Phocoena phocoena)*[73]. Habitat maps of some cetacean species were generated in Scotland's Marine Assessment 2020 and show that cetacean habitat overlaps with sandeel habitat[74]. In particular, population density modelling of harbour porpoise (Figure 7) shows that this species has strong affinity with sandeel habitat.

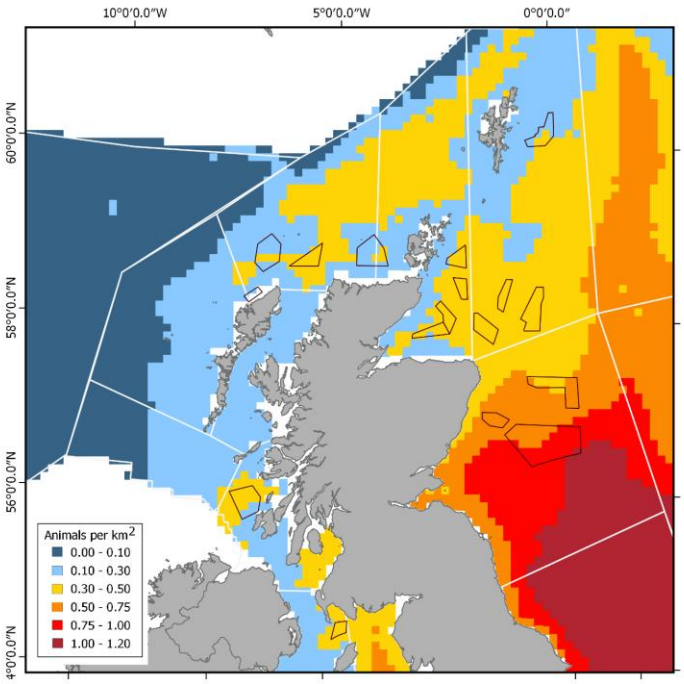

Figure 7. Predicted density of harbour porpoise in Scottish waters in 2016.Draft Plan Option Areas are outlined in black for reference. SCANS-III survey blocks are marked in white (Hague et al. 2021).

Harbour porpoises are widely distributed throughout Scottish waters, with in the highest observed densities of harbour porpoise in Scotland generally in the North Sea[75], where porpoises seem to prefer similar depth ranges as on the west, as well as sandy habitats that are typically favoured by sandeel, such as the gravelly sand seabed area of Smith Bank in the middle of the Moray Firth. Harbour porpoises in Scottish waters have been found to feed predominately on whiting and sandeel[76] with sandeel being particularly important during the spring and summer[77]. More recent diet data for harbour porpoise in the northern North Sea

[71] Distribution maps of cetacean and seabird populations in the North-East Atlantic - Waggitt - 2020 - Journal of Applied Ecology - Wiley Online Library
[72] Inter Research » MEPS » v277 » p263-274 (int-res.com)
[73] Linking sandeel consumption and the likelihood of starvation in harbour porpoises in the Scottish North Sea: could climate change mean more starving porpoises? | Biology Letters (royalsocietypublishing.org)
[74] Cetaceans | Scotland's Marine Assessment 2020
[75] Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., 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 final report.
[76] Santos, M.B. & Pierce, G.J. (2003). The diet of harbour porpoise (Phocoena phocoena) in the northeast Atlantic. Oceanography and Marine Biology: an Annual Review 41: 355-390.
[77] Santos, M.B., Pierce, G.J., Learmonth, J.A., Reid, R.J., Ross, H.M., Patterson, I.A.P., Reid, D.G. & Beare, D. (2004). Variability in the diet of harbor porpoises (Phocoena phocoena) in Scottish waters 1992–2003. Marine Mammal Science 20:1-27.

are unavailable. However, studies on stranded harbour porpoise in the southern North Sea[78] [79] found gobies, gadids, clupeids and sandeel to be the main diet components.

A diet study on stomach contents of ten stranded minke whales in Scotland showed that sandeel were the most important prey species and contributed two-thirds of the individual diet, by weight diet[80]. These findings have been supported by other studies in the wider North Sea region. A study found sandeel to comprise 86.7% of the weight of the prey species found in the stomach contents of minke whales caught by Norwegian whalers in 1999[81]. However, the proportion of sandeel dominance appeared to change between years.

White-beaked dolphins *(Lagenorhynchus albirostris)* are present in Scottish waters year-round, with a wide distribution that favours both offshore and nearshore areas depending on the region. The main areas of white-beaked dolphin overlap with high probability of sandeel occurrence is the offshore waters of the east coast, concurrent with increased sandeel availability in the water column during summer months where seasonal white-beaked dolphin density is also highest. Sandeel were present in a diet study of a small number of white beaked dolphins[82] but gadids are thought to be the predominant prey items in the North Sea[83] [84].

5.4.3 Vulnerability to sandeel variation

Sandeel are an abundant, but declining food source in much of the distributional ranges of the marine mammal species described above. However, the reliance on sandeel and subsequent susceptibility to fluctuations in sandeel abundance and distribution differ among marine mammal species. Furthermore, the varying vulnerability of marine mammals to declines in sandeel abundance is a complex and stochastic interaction between prey distributions, diet, predator and prey demography, and predator foraging distributions and behaviour so predictions are subject to considerable uncertainty.

Sandeel are a high-quality, lipid-rich prey source and improved body condition in marine mammals has been linked to the proportion of sandeel in their diet. For example, a correlation was found between harbour porpoises in better body condition and higher amounts of fatty fish in their diet[85] and, links between consumption of sandeel and health status of porpoises suggested that a decrease in sandeel availability could have negative

[78] Leopold, M. F. (2015). Eat and be eaten, Porpoise diet studies. PhD thesis.
[79] Lambert, E. (2020). The feeding ecology of the harbour porpoise Phocoena phocoena L. in a changing environment (Doctoral dissertation, MSc. Thesis, Marine and Lacustrine Science and Management, Universiteit Antwerpen, Universiteit Gent, Vrije Universiteit Brussel).
[80] Santos, M.B., Pierce, G.J., Learmonth, J.A., Reid, R.J., Ross, H.M., Patterson, I.A.P., Reid, D.G. & Beare, D. (2004). Variability in the diet of harbor porpoises (Phocoena phocoena) in Scottish waters 1992–2003. Marine Mammal Science 20:1-27.
[81] Olsen, E. &Holst, J.C., (2001). A note on common minke whale (Balaenoptera acutorostrata) diets in the Norwegian Sea and the North Sea. Journal of Cetacean Research and Management, 3(2), pp.179-184.
[82] Santos, M. B., Pierce, G. J., Ross, H. M., Reid, R. J., & Wilson, B. (1994). Diets of small cetaceans from the Scottish coast. ICES, Copenhagen, Denmark.
[83] Canning, S., Santos, M., Reid, R., Evans, P., Sabin, R., Bailey, N., & Pierce, G. (2008). Seasonal distribution of white-beaked dolphins (Lagenorhynchus albirostris) in UK waters with new information on diet and habitat use. Journal of the Marine Biological Association of the United Kingdom, 88(6), 1159-1166.
[84] Jansen, O., Leopold, M., Meesters, E., & Smeenk, C. (2010). Are white-beaked dolphins Lagenorhynchus albirostris food specialists? Their diet in the southern North Sea. Journal of the Marine Biological Association of the United Kingdom, 90(8), 1501-1508.
[85] Leopold, M. F. (2015). Eat and be eaten, Porpoise diet studies. PhD thesis.

effects on porpoise populations[86]. The predicted consumption of sandeel is high in porpoise diets, despite an abundance of other available prey species. Further, consumption of sandeel is significantly greater than all other prey types even when abundances are roughly equal[87].

Multi-species functional responses have been published which indicate that when energy rich prey-species (i.e., sandeel) are scarce, porpoises must increase the total biomass consumed to avoid shortfalls in energy intake[88] and by extension, poor body condition. As a result, minor differences in overall biomass and energetic intake were predicted between 2011 and 2022 (a period of pronounced sandeel decline in abundance across their range). Porpoise may subsequently travel greater distances or shift their ranges in search of a higher biomass of prey or increased densities of other high energy prey.

Declines in sandeel stocks could have implications on inter-specific competition between marine mammal species in situations where sandeel are the primary food source. If sandeel are scarce, the considerable overlap in diet between grey and harbour seals could result in exploitative competition which could impact one or both species. With harbour seals noted to be in significant decline in certain regions of Scotland, a depletion in sandeel stocks could be a factor in the further decline of harbour seals as indicated by the continuing decline in areas where seals show high preference for sandeels and little plasticity in diet[89].

5.5 Other fish caught by the sandeel fishery

Whiting and mackerel are caught as bycatches in the sandeel fishery; and whiting aggregate at sites of high sandeel abundance[90]. It is expected that any benefits to sandeel through the closure of the sandeel fishery may benefit whiting and mackerel also, although it is expected that these benefits would be to a lesser extent than for sandeel as they are not the target species of this fishery.

6. Call for Evidence on future management of Sandeel and Norway pout

Between 22 October and 19 November 2021 Scottish Government worked closely with the UK Government on a call for evidence to gather information to better inform considerations on future management for sandeel. A summary of the responses to the Call for Evidence was published on gov.uk[91]. The main themes and points raised by respondents to the call for evidence are summarised below.

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[86] MacLeod, C.D., Santos, M.B., Reid, R.J., Scott, B.E. & Pierce, G.J., (2007). Linking sandeel consumption and the likelihood of starvation in harbour porpoises in the Scottish North Sea: could climate change mean more starving porpoises? Biology letters, 3(2), pp.185-188.

[87] Ransijn, J.M., Hammond, P.S., Leopold, M.F., Sveegaard, S. & Smout, S.C., (2021). Integrating disparate datasets to model the functional response of a marine predator: A case study of harbour porpoises in the southern North Sea. Ecology and Evolution, 11(23), pp.17458-17470.

[88] Ransijn, J.M., Hammond, P.S., Leopold, M.F., Sveegaard, S. & Smout, S.C., (2021). Integrating disparate datasets to model the functional response of a marine predator: A case study of harbour porpoises in the southern North Sea. Ecology and Evolution, 11(23), pp.17458-17470.

[89] Wilson & Hammond, P. (2019). The diet of harbour and grey seals around Britain: Examining the role of prey as a potential cause of harbour seal declines. Aquatic Conservation, Marine and Freshwater Ecosystems Vol 29 1:71-85.

[90] Predation of whiting and haddock on sandeel: aggregative response, competition and diel periodicity - Temming - 2004 - Journal of Fish Biology - Wiley Online Library

[91] https://www.gov.uk/government/consultations/future-management-of-sandeel-and-norway-pout-in-uk-waters-call-for-evidence/outcome/summary-of-responses.

Respondents acknowledged that sandeels and Norway pout have high ecological value to the entire marine ecosystem:

- they form the base of many food webs - being an important food source for predatory fish, seabirds and marine mammals
- they convert energy from primary producers into fish biomass - allowing this energy to travel up the trophic levels

Respondents also noted that sandeel and Norway pout fishing have high economic value to some EU nations, who rely on UK waters to access these fisheries, to support their fishmeal and fish oil industries. However, many respondents felt that these fisheries bring little economic value to the UK.

Many respondents believe a change in management approaches for sandeels and Norway pout is required. Opinions varied on the constitution of such management measures but broadly consisted of:

- a total closure of the UK exclusive economic zone (EEZ) to sandeel and Norway pout fishing or Total Allowable Catches (TACs) reduced to zero or near zero
- taking an ecosystem-based approach to the management of sandeels and Norway pout, incorporating 'set-aside' and reducing catch limits downwards
- implementation of, or ideas taken from, the Norwegian model (including in season monitoring and adaptative management and late start of the season) of sandeel stock management while keeping the fisheries open

Respondents noted that the introduction of new restrictions in these fisheries could lead to:

- positive ecological impacts by allowing these stocks to recover and support the health of the rest of the marine ecosystem
- negative economic impacts on some nations, who have previously fished in UK waters, which may therefore lead to negative impacts for the fishmeal and fish oil industries
- positive social impacts for tourism and recreational angling opportunities with the bounce back of healthy fish, seabird, and marine mammal populations
- negative social impacts for those involved in these fisheries either recreationally or industrially, through lack of employment and opportunities

7. Displacement

One common response of a fishery to an area closure is fisheries displacement, in which the vessels concerned move to a different area to fish (spatial displacement) or change their fishing gear and methods to focus on different species (species switching). Sandeel in area 4 is managed as a single stock and catching levels are set in line with the agreed TAC level following the annual UK-EU bilateral agreement. The current ICES advice for sandeel indicates that the assessment model does not take account of the current area closure for sandeel (refer to section 3.2), meaning that the available TAC must be taken from a smaller area than intended. This situation would be exacerbated if the fishery closure was extended subject to the outcome of this consultation. However, without a robust model of fleet dynamics (which does not yet exist for these fisheries) or an extensive consultation with the

international fishing industry, it is impossible to determine what the response of the fleet would be to an area fisheries closure in Scottish waters.

To inform the consultation, the environmental impacts of fisheries displacement as a result of any extension to the closed area is considered in the SEA Environmental Report. This report can be found along other supporting documents to this consultation.

Furthermore, the UK government consulted on potential spatial management measures for sandeel in English waters in spring 2023. If the UK Government proceed with such measures, then this would mitigate the risk of displacement of activity into English waters. On the other hand, spatial management measures for sandeel in English waters may risk displacement of fishing activity wholly into Scottish waters if the option presented in this consultation for Scottish waters is not pursued. It is also expected that fisheries effort might be displaced into non-UK waters should the sandeel fishery closure in Scottish waters presented in this consultation be pursued.

8. Potential impact on business

Sandeel quota has not been allocated to UK vessels since 2021, therefore only a partial Business and Regulatory Impact Assessment (BRIA) has been produced. It summarises the expected impact on Scottish, UK and non-UK businesses of the proposals presented in this consultation.

The EU catching sector is expected to be most affected by any management measures introduced for all Scottish waters, with Scottish businesses anticipated to be impacted minimally. We would anticipate that the outcome of the consultation could clarify the assumptions underlying the BRIA assessment. This assessment can be found along other supporting documents to this consultation.

The BRIA also outlines the anticipated costs and benefits of the preferred option. Again, we would encourage respondents to draw to our attention any additional costs, benefits, and unintended consequences of the preferred option.

9. Conclusion

Sandeel play an important role in the North Sea food web as a key resource for predatory fish, seabirds and marine mammals. Declines in sandeel availability and abundance may negatively impact the survival and reproduction of ecologically important species, therefore closure of the sandeel fishery has the potential to bring about wider ecosystem benefits to a range of species as well as improving resilience to changes in the marine environment. For example, restricting sandeel fishing may lead to an increase in sandeel abundance, survival and potentially availability, thereby providing benefits to other North Sea top predators, including key whitefish species, seabirds and marine mammals.

Previous sandeel closures on the east coast of Scotland have shown how breeding success in some seabird species is influenced by the abundance and availability of sandeel. Furthermore, improved body condition in some marine mammal species has also been linked to the proportion of sandeel in their diet. Therefore, any increase in sandeel abundance that might result from a reduction in fishing pressure could be beneficial to several marine predators given their dependence on sandeel as a prey source.

However, the extent to which these benefits could be realised for predatory fish, seabirds and marine mammals is unpredictable due to variation in sandeel abundance and availability which is driven by fishing mortality and, to a large extent, by natural mortality which is influenced by prevailing environmental conditions (including climate change) and predation. Any benefits, if realised, would not be immediate and would vary with location and species. In the case of seabirds, many global populations are declining with breeding seabirds in the UK not meeting GES. Seabirds face a range of pressures including habitat loss, biosecurity, infectious disease (such as Highly Pathogenic Avian Influenza), climate change, storm events, human disturbance to breeding birds and predation of both chicks and adult seabirds. Maximising the abundance and availability of sandeel stock as prey for seabirds (through the introduction of management measures in Scottish waters) therefore remains a key mechanism by which resilience in seabird populations might be achieved.

Closure of the sandeel fishery in Scottish waters could also reduce bycatch of valuable fish stocks such as whiting, haddock and mackerel.

This evidence is supported by the outcomes of a public call for evidence in 2021 to better inform considerations on the future management of sandeel in UK waters. These responses acknowledged that sandeel has a high ecological value to the entire marine ecosystem and most responses were in favour of implementing new management measures for sandeel.

Subject to the outcome of this consultation, the Scottish Government proposes to close fishing for sandeel in all Scottish waters from the 2024 fishing season onwards.

Views are invited on all issues raised in this paper and responses to the questions posed in Annex B. **We would ask for views to be received no later than 13 October 2023 and the team is available to discuss.**

What questions does the consultation seek to consider?

1. Do you support the preferred option to close fishing for sandeel in all Scottish waters?

2. If your answer is no to question 1. do you have any views on alternative or complementary measures that could be considered in the longer-term for the protection of sandeel in Scottish waters (please see the SEA Environmental Report for alternatives).

3. Is there any further evidence that should be considered in terms of the potential benefits or value of the preferred option that could be considered?

4. Is there any further evidence that should be considered to demonstrate any impact on island communities?

5. Do you have any comments on the assumptions made in the partial Business and Regulatory Impact Assessments (BRIA) concerning the costs and benefits of the option?

6. Do you have any comments on the SEA Environmental Report?

Annex A - Consultation period and responses to the consultation

We are inviting responses to this consultation by 13 October 2023.

Please respond to this consultation using the Scottish Government's consultation hub, Citizen Space (http://consult.gov.scot). Access and respond to this consultation online at https://consult.gov.scot/marine-scotland/consultation-on-proposals-to-close-fishing/. You can save and return to your responses while the consultation is still open. Please ensure that consultation responses are submitted before the closing date of 13 October 2023.

If you are unable to respond using our consultation hub, please complete the Respondent Information Form and return by email to: sandeelconsultation@gov.scot.

Handling your response
If you respond using the consultation hub, you will be directed to the About You page before submitting your response. Please indicate how you wish your response to be handled and, in particular, whether you are content for your response to published. If you ask for your response not to be published, we will regard it as confidential, and we will treat it accordingly.

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made to this consultation exercise.

If you are unable to respond via Citizen Space, please complete and return the Respondent Information Form included in this document.

To find out how we handle your personal data, please see our privacy policy: https://www.gov.scot/privacy/

Next steps in the process
Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public at http://consult.gov.scot. If you use the consultation hub to respond, you will receive a copy of your response via email.

Following the closing date, all responses will be analysed and considered along with any other available evidence to help us. Responses will be published where we have been given permission to do so. An analysis report will also be made available.

Comments and complaints
If you have any comments about how this consultation exercise has been conducted, please send them to sandeelconsultation@gov.scot.

Scottish Government consultation process
Consultation is an essential part of the policymaking process. It gives us the opportunity to consider your opinion and expertise on a proposed area of work.

You can find all our consultations online: http://consult.gov.scot. Each consultation details the issues under consideration, as well as a way for you to give us your views, either online, by email or by post.

Responses will be analysed and used as part of the decision making process, along with a range of other available information and evidence. We will publish a report of this analysis for every consultation. Depending on the nature of the consultation exercise the responses received may:

- indicate the need for policy development or review
- inform the development of a particular policy
- help decisions to be made between alternative policy proposals
- be used to finalise legislation before it is implemented

While details of particular circumstances described in a response to a consultation exercise may usefully inform the policy process, consultation exercises cannot address individual concerns and comments, which should be directed to the relevant public body.

Privacy policy

Our contact details

The Scottish Government is the data controller for the personal information we process. Personal data in relation to this consultation will be processed by the Marine Directorate.

Scottish Government
St. Andrew's House
Regent Road
Edinburgh EH1 3DG

Email: sandeelconsultation@gov.scot

The type of personal information we collect, and how and why we collect this information

Through this consultation, we will collect and process the following information provided in responses submitted both through Citizen Space and Respondent Information Forms:

- Personal identifiers, contacts and characteristics (name and email address).

- Any additional personal data included in the free text response.

An email address is a required field as part of any response submitted through Citizen Space or a Respondent Information Form. The collection of an email address within the response allows a confirmation of the consultation response to be sent, and will allow you access your response and change your answers whilst the consultation period is underway.

Following the close of the consultation, an outcome report will be published online. Responses will be published alongside this, in accordance with respondents' expressed publication preferences. Before publication of responses, they will be checked for any personal data included in the free-text response to the consultation question, and any personally identifiable information will be removed.

Where respondents have given permission for their response to be published, with or without their name, and after the Scottish Government has redacted any defamatory content, consultation responses will be published at http://consult.gov.scot.

Under the UK General Data Protection Regulation (UK GDPR), the lawful bases we rely on for processing this information is that we need it to perform a public task.

How we store your personal information

Your information will be securely stored, and retained in line with the Scottish Government retention policy. A review will be carried out after 1 year to decide whether data is still required to be retained, in order to evidence and/or inform policy decisions relating to the consultation. If there is no rationale to justify continuing to hold the data it will be destroyed. If data continues to be held, reviews will be held annually.

Your data protection rights

Under data protection law, you have rights including:

Your right of access - You have the right to ask us for copies of your personal information.

Your right to rectification - You have the right to ask us to rectify personal information you think is inaccurate. You also have the right to ask us to complete information you think is incomplete.

Your right to restriction of processing - You have the right to ask us to restrict the processing of your personal information in certain circumstances.

Your right to object to processing - You have the right to object to the processing of your personal information in certain circumstances.

Your right to data portability - You have the right to ask that we transfer the personal information you gave us to another organisation, or to you, in certain circumstances.

You are not required to pay any charge for exercising your rights. If you make a request, we have one month to respond to you.

Please contact us at dpa@gov.scot if you wish to make a request.

How to complain

If you have any concerns about our use of your personal information, you can make a complaint to us at The Scottish Government DPO.

The DPO's address:

Data Protection Officer
Victoria Quay
Commercial Street
Edinburgh
EH6 6QQ

Email: DataProtectionOfficer@gov.scot

You can also complain to the ICO if you are unhappy with how we have used your data.

The ICO's address:

Information Commissioner's Office
Wycliffe House
Water Lane
Wilmslow
Cheshire
SK9 5AF

Helpline number: 0303 123 1113

ICO website: https://www.ico.org.uk

All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and The Environmental Information (Scotland) Regulations 2004 and would therefore have to consider any request made to it under these Acts for information relating to responses made to this consultation exercise. In the event of a request for information under these Acts, personal details would be redacted.

If you have any comments about how this consultation exercise has been conducted, please send them to the same address as for your response.

Annex B - Respondent Information Form

Please Note this form **must** be completed and returned with your response.

To find out how we handle your personal data, please see our privacy policy: https://www.gov.scot/privacy/

Are you responding as an individual or an organisation?

☐ Individual

☐ Organisation

Full name or organisation's name

Phone number

Address

Postcode

Email Address

The Scottish Government would like your permission to publish your consultation response. Please indicate your publishing preference:

☐ Publish response with name

☐ Publish response only (without name)

☐ Do not publish response

Information for organisations:

The option 'Publish response only (without name)' is available for individual respondents only. If this option is selected, the organisation name will still be published.

If you choose the option 'Do not publish response', your organisation name may still be listed as having responded to the consultation in, for example, the analysis report.

We will share your response internally with other Scottish Government policy teams who may be addressing the issues you discuss. They may wish to contact you again in the future, but we require your permission to do so. Are you content for Scottish Government to contact you again in relation to this consultation exercise?

☐ Yes

☐ No

CONSULTATION QUESTIONS

Question 1: Do you support the preferred option to close fishing for sandeel in all Scottish waters?

Comments:

Question 2: If your answer is no to question 1. do you have any views on alternative or complementary measures that could be considered in the longer-term for the protection of sandeel in Scottish waters (please see the SEA Environmental Report for alternatives)?

Comments:

Question 3: Is there any further evidence that should be considered in terms of the potential benefits or value of the preferred option that could be considered?

Comments:

Question 4: Is there any further evidence that should be considered to demonstrate any impact on island communities?

Comments:

Question 5: Do you have any comments on the assumptions made in the partial Business and Regulatory Impact Assessments (BRIA) concerning the costs and benefits of the option?

Comments:

Question 6: Do you have any comments on the SEA Environmental Report

Comments:

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Any enquiries regarding this publication should be sent to us at

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

ISBN: 978-1-83521-129-8 (web only)

Published by The Scottish Government, July 2023

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA
PPDAS1325422 (07/23)

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