Received: 15 November 2022 | Revised: 14 July 2023 | Accepted: 24 July 2023

DOI: 10.1002/aqc.4004

POLICY

WILEY

Porpoises, by-catch and the 'pinger' conundrum

Eunice H. Pinn

School of Law, University of Aberdeen, Aberdeen, UK

Correspondence
Eunice H. Pinn School of Law, University of Aberdeen, Taylor Building, Aberdeen, AB24 3UB, UK.
Email: eunice.pinn@abdn.ac.uk

Abstract

1. The UK is committed to reducing or eliminating the by-catch of protected species in fisheries. Of key concern is the by-catch of harbour porpoise in static nets. Fishers do not want to catch harbour porpoise, and the only proven effective mitigation measure currently available is an acoustic device known as a 'pinger'.
2. Legislative requirements for the mandatory use of pingers on larger vessels (i.e. those greater than 12 m in length) has resulted in a by-catch reduction of approximately 17% for the UK fleet annually. In most areas where the risk of by-catch is high (i.e. the southern North Sea, English Channel, and Bristol Channel), smaller inshore vessels (i.e. less than 12 m in length) account for over 90% of the fishing effort (determined as days at sea).
3. Small inshore vessels are not permitted to use pingers without a licence. The information required for a licence, however, makes it extremely difficult for fishers to obtain one. Without access to effective mitigation in most of the static net fleet, it seems unlikely that the UK will meet its ambition to minimize or eliminate harbour porpoise by-catch.
4. Finding workable and effective solutions for smaller vessels is essential. As harbour porpoise by-catch is such a rare event, it is unlikely that the mandatory use of pingers on all static net vessels will be cost-effective. Nor is such widespread deployment considered desirable because of the potential consequences on the conservation status of harbour porpoise. A potential solution within the current UK legislative framework is proposed that would facilitate the use of pingers in small-scale localized fisheries with a high risk of by-catch until a suitable mitigation alternative to pingers becomes available.

KEYWORDS

by-catch, marine mammal, pinger, porpoise, protected species, technical measures

1 | INTRODUCTION

Harbour porpoise (*Phocoena phocoena*) are the smallest and one of the most numerous cetacean species in European Atlantic waters (Hammond et al., 2021). By-catch, i.e. the accidental capture and death in fishing gear, is recognized as being the most significant anthropogenic threat to the species in UK waters (Coram & Northridge, 2018; Calderan & Leaper, 2019; Scottish Government, 2021) and more widely throughout the northern hemisphere (Bjørge, Skern-Mauritzen & Rossman, 2013; Brownell

et al., 2019; Evans, Carrington & Waggitt, 2021; Rogan, Read & Berggren, 2021; Königson et al., 2022).

The UK has had a long-standing commitment to reduce or eliminate the by-catch of protected species, such as cetaceans, in fishing activities. For the UK, the focus on cetacean by-catch specifically originates from the early 1990s when the country became a party to the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS). A commitment to general conservation measures to protect harbour porpoise has also been made through, for example, the Convention on the Conservation of Migratory Species of Wild Animals (CMS, 1979), the Convention on the Conservation of European Wildlife and Natural Habitats (1979), and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR, 1992).

These international commitments aim for the reduction of by-catch to below a level at which it negatively impacts the conservation status of the species. This threshold is generally considered to be to less than 1% of the best population estimate (IWC, 1999; ASCOBANS, 2000; Bergen Declaration, 2002; ASCOBANS, 2016; OSPAR, 2017; ASCOBANS, 2020). At the UK national level, these international commitments have been strengthened through the ecosystem objectives of the Fisheries Act, 2020. This Act provides the legal framework for the UK to operate as an independent coastal state under the United Nations Convention on the Law of the Sea, 1982 (UNCLOS) after leaving the EU and withdrawing from the Common Fisheries Policy (EU Regulation 1380/2013, n.d.).

The Fisheries Act, 2020 notes that the by-catch of sensitive species will be 'minimised and, where possible, eliminated'. This is further supported in the Joint Fisheries Statement (n.d.), which explicitly states that 'national fisheries authorities are committed to working with the fishing industry to minimise, and where possible eliminate, the unwanted by-catch and entanglement of sensitive species including cetaceans (whales, dolphins and porpoises), seals, seabirds, and elasmobranchs (sharks, skates and rays)'. Subsequently, these policy ambitions have been further articulated through the Marine Wildlife Bycatch Mitigation Initiative (BMI) (Defra, 2022). The BMI identifies a series of activities and potential actions that could be used to help achieve the UK's ambition to eliminate by-catch. Although the BMI is focused on the by-catch of protected species, it is also linked to the UK's wider commitments to sustainable fisheries, including a need to tackle the discarding of commercially important fish species.

2 | MITIGATION OF HARBOUR PORPOISE BY-CATCH

The monitoring work undertaken by the UK Bycatch Monitoring Programme has demonstrated that harbour porpoise by-catch most often occurs in static nets (e.g. bottom-set gillnets, trammel nets, and tangle nets), primarily in the south west (Kingston, Thomas & Northridge, 2021). Mitigation measures for the static net fleet have focused on the use of acoustic devices, known as 'pingers'. These deter the porpoises from the vicinity of the nets and have generally proven very effective (Dawson et al., 2013; Kindt-Larsen et al., 2019; McGarry et al., 2020; Brennecke et al., 2022; Königson et al., 2022).

Mandatory requirements for the use of pingers were first introduced through EU Regulation 812/2004, laying down measures concerning incidental catches of cetaceans in fisheries. The use of pingers is required on gillnets or entangling nets deployed from larger vessels (i.e. vessels greater than 12 m in length) in the south west of the UK (International Council for the Exploration of the Sea (ICES) areas 7d–j) all year round. Their use is also required in the North Sea (ICES area 4) on gillnets or entangling nets with a mesh size of ≥220 mm deployed from a vessel of >12 m in length all year round, or on gillnets and entangling nets of <400 m in length deployed from vessels of >12 m between 1 August and 31 October.

Since the introduction of EU Regulation 812/2004 (n.d.), there have been issues with its implementation and effectiveness (STECF, 2019). For example, in the North Sea, pingers are not required for gillnets or entangling nets of >400 m in length deployed between 1 November and 31 July. The need for pingers is therefore easily circumvented by extending the total length of the nets to more than 400 m. As harbour porpoise are present year-round, there is no justification for the seasonal use of mitigation. At the time the legislation was introduced, the pinger models specified for use required significant changes to fishing practice, which led to safety concerns from fishers; nor were the pingers sufficiently robust for many commercial fishery situations (Seafish, 2003; Cosgrove, Browne & Robson, 2005; Seafish, 2005). As the focus of the legislation was on vessels of >12 m in length, little to no attention was given to the mitigation needs of smaller inshore vessels. EU Regulation 812/2004 has now been repealed, with the requirement to reduce the by-catch of protected species implemented through EU Regulation 2019/1241 (n.d.).

Between 2015 and 2019, the mandatory use of pingers on the larger gillnet vessels in the UK fleet is estimated to have saved approximately 220 porpoises per year from by-catch (Northridge, Kingston & Thomas, 2016; Northridge, Kingston & Thomas, 2017; Northridge, Kingston & Thomas, 2018; Northridge, Kingston & Thomas, 2019; Kingston, Thomas & Northridge, 2021). For the remainder of the static net fleet, with no pinger use, it is estimated that approximately 1,100 porpoises per year were by-caught. The mandatory use of pingers equates to a reduction in by-catch of approximately 17% annually.

Although mitigation measures are focused on vessels of >12 m in length because of their observed higher by-catch rate, smaller inshore vessels (≤12 m) using static nets are responsible for the majority of the by-catch (Coram & Northridge, 2018; ICES, 2022). In the UK, there are 203 active smaller inshore vessels using static nets, compared with 26 larger vessels (Seafish, 2022). Additionally, there are a further 1,351 low-activity inshore vessels potentially using static nets as well as other gear types (Seafish, 2022). Low-activity vessels are defined as those with an annual landings value of less than £10,000 (Moran-Quintana, Motova & Witteveen, 2020), and on average fishing for fewer than 18 days per year. More importantly, the smaller inshore vessels account for over 90% of the fishing effort (determined as days at sea) in the southern North Sea (ICES area 4c) and English Channel (ICES

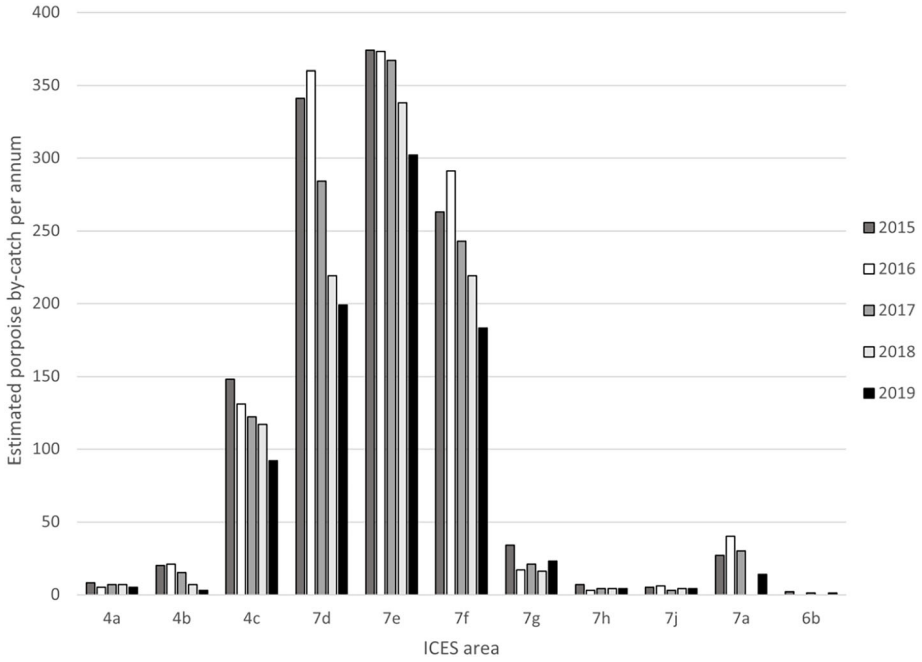

FIGURE 1 Harbour porpoise by-catch for the UK static net fleet by ICES area between 2015 and 2019. (By-catch estimates provided by Northridge, Kingston & Thomas, 2016; Northridge, Kingston & Thomas, 2017; Northridge, Kingston & Thomas, 2018; Northridge, Kingston & Thomas, 2019; and Kingston, Thomas & Northridge, 2021).

TABLE 1 UK static net fishing effort and estimated harbour porpoise by-catch by ICES area for 2019.

ICES area	2019 fishing effort (days at sea)[a]			2019 estimated harbour porpoise by-catch with mandatory pinger use (95% confidence range)[b]
	<12 m static net vessels	>12 m static net vessels	Percentage of fishing effort attributed to <12 m vessels	
4a: Northern North Sea	0	593	0	5 (2–38)
4b: Central North Sea	17	1	94	3 (3–4)
4c: Southern North Sea	1,959	0	100	92 (65–136)
7d: Eastern English Channel	7,974	33	99	199 (125–346)
7e: Western English Channel	7,061	839	90	304 (217–431)
7f: Bristol Channel	1,388	580	71	183 (139–241)
7 g: Celtic Sea North	211	968	18	23 (10–90)
7 h: Celtic Sea South	0	351	0	4 (0–22)
7j: South West of Ireland East	0	338	0	4 (1–20)
7a: Irish Sea	218	10	96	14 (7–25)
6b: Rockhall	0	252	0	1 (0–13)

[a]Data obtained from Seafish (2022).
[b]Data obtained from Kingston, Thomas and Northridge (2021).

areas 7d and e) and for over 70% in the Bristol Channel (ICES area 7f), which are all areas identified as being of highest by-catch risk for harbour porpoise in UK waters (Figure 1; Table 1; Evans, Carrington & Waggitt, 2021; Greig, 2021; Irvine, 2022). Consequently, enabling the use of effective mitigation measures, such a pingers, on smaller static net vessels is required if the by-catch is to be further reduced.

3 | THE PINGER CONUNDRUM

Through Council Directive 92/43/EEC (1992) on the conservation of natural habitats and of wild fauna and flora (i.e. the Habitats Directive), the by-catch of protected species such as harbour porpoise has generally been considered to represent incidental killing, i.e. accidental. However, where accidental by-catch was found to be having a negative impact on the conservation status of the species, the Habitats Directive requires the use of mitigation measures. Following a complaint to the European Commission by 22 nongovernmental organizations (NGOs) (Butler-Stroud & Rouley, 2019; ClientEarth., 2019), treating by-catch as accidental may no longer be acceptable. Based on existing EU case law, the act of fishing could be considered equivalent to deliberate killing if fishers set their gear knowingly aware that there is a risk of cetacean by-catch without using mitigation measures (ICES, 2020a). The spatial and temporal variation in the distribution of porpoises and fishing effort, however, makes predicting the occurrence of by-catch inherently difficult.

Although the conservation status of harbour porpoise is considered favourable for the European Atlantic region, the UK considers the conservation status to be unknown (JNCC, 2019; Pinn, Macleod & Tasker, 2021). This 'unknown' conclusion was drawn as a result of a decline in national abundance, although not statistically significant, and the lack of information regarding habitat quality. Concerns have been raised regarding by-catch. For the Celtic Seas (ICES areas 7d–j), harbour porpoise by-catch was found to be above the precautionary threshold of 1% of the best population estimate (Mitchell, Macleod & Pinn, 2018; Moan et al., 2020).

Fishers do not want to catch porpoises. On the individual vessel level, the occurrence of porpoise by-catch is generally a rare event (Hoos et al., 2019; Northridge, Kingston & Thomas, 2019). Many fishers therefore find it hard to comprehend how these once or twice occurrences in a career could pose a conservation issue. However, the incidence of by-catch can be significant in some small-scale, short-term inshore seasonal fisheries. Where this greater risk of by-catch occurs, fishers want to be able to proactively stop it from happening. Pingers introduce high-frequency noise into the environment, which causes disturbance (Williams et al., 2020; Lusseau, Kindt-Larsen & van Beest, 2023). In the UK, the use of pingers is licensed through the Wildlife and Countryside Act, 1981, unless there is a legal requirement to use them through other legislation (e.g. EU Regulation 2019/1241, n.d.). Consequently, fishers deploying static nets from small inshore vessels must obtain a Marine Wildlife Licence to use pingers as a mitigation tool. Inshore fishers using pingers on their nets without a licence are committing an offence and operating illegally.

To apply for a Marine Wildlife Licence, the applicant must provide: a detailed description of the location, including the specific coordinates and times where the pingers will be used; the protected species and number of individuals potentially affected; as well as details of two referees who can provide a statement on the skills and experience of the applicant to ensure that they have adequate knowledge to use pingers. To date, there have been no successful Marine Wildlife Licence applications made by fishers. For example, Marine Wildlife Licence application MLA/2018/00160 was refused on the grounds that it was unclear whether there was a significant by-catch issue in the area. This was despite the fishers reporting an average of two or three incidents per week during the small localized and short seasonal fishery. The licence refusal also raised concerns about the habituation of harbour porpoise to the devices and the potential for habitat exclusion. This places fishers in an incredibly difficult position: should they commit a disturbance offence by using a mitigation measure that could significantly reduce the risk of committing a deliberate killing offence?

4 | EVIDENCE FOR PORPOISE HABITUATION AND/OR EXCLUSION

From the licensing perspective, the key concerns raised regarding the use of pingers as a mitigation measure are habituation and exclusion. The term habituation is defined as simple, non-associative learning, in which the magnitude of the response by an individual to a specific stimulus decreases with repeated exposure (Thompson & Spencer, 1966). In other words, if porpoises frequently encounter pingers, they will begin to ignore the signal and will no longer be displaced from the vicinity of nets, i.e. the pingers become ineffective over time and by-catch will increase. Some work on pinger effectiveness has indicated that porpoises may approach pingers more closely over time (Cox et al., 2001; Carlström, Berggren & Tregenza, 2009; Kindt-Larsen et al., 2019), whereas no evidence of this was found in other studies (Culik et al., 2001; Palka et al., 2008; Carretta & Barlow, 2011; Omeyer et al., 2020). More recent investigations with modern pingers using higher frequency randomized pulses have found little evidence of habituation (Kindt-Larsen et al., 2019; Omeyer et al., 2020; Königson et al., 2022). Notably, to date, there has been no evidence of an increase in by-catch linked to the long-term use of pingers in commercial fishing operations (ICES, 2021; Moan & Bjørge, 2023).

The corollary to habituation is exclusion. Any habitat exclusion will diminish if habituation occurs. Given that the function of pingers is to keep porpoises away from the nets, some level of exclusion is clearly desirable. This only becomes a concern if the habitat exclusion is widespread and long term. In such a situation, it is thought that the use of pingers could force porpoises into using suboptimal areas (Sveegaard et al., 2011; Dawson et al., 2013; van Beest et al., 2017; Kindt-Larsen et al., 2019; Brennecke et al., 2022). Widespread and long-term habitat exclusion is likely to affect individual fitness and, therefore, the future conservation status of the population. This has been a particular concern when considering the use of pingers within protected areas specifically designated for the species. At the wider population scale, displacement is unlikely to be problematic given the large ranges of the animals and the habitat available, when compared with the area impacted by pinger noise (Sveegaard et al., 2011; Pinn, Macleod & Tasker, 2021). It is only where the movement of animals is constrained that displacement could become a potential conservation concern (Kyhn et al., 2015; Todd, Jiang & Ruffert, 2019). Specifically, for the south-west UK (ICES areas 7d–j), Northridge et al. (2011) estimated that when static net fishing is at its most intensive (in June), the deployment of pingers of the type specified by EU Regulation 812/2004 on all nets (regardless of vessel size) would ensonify between 0.08% and 0.28% of the area.

Although there needs to be a balance between the conservation issues of by-catch and displacement; mortality is clearly less desirable than displacement. For many of the modern pingers, there is no evidence of any long-term habitat exclusion for porpoises linked with their use. When pingers are active, individual animals move away from the sound, but the effect of pingers is very localized and when the pingers are switched off, porpoises rapidly return to the area (Kindt-Larsen et al., 2019; Omeyer et al., 2020; Königson et al., 2022).

Through modelling, Lusseau, Kindt-Larsen & van Beest (2023) have explored the use of pingers and closed areas on by-catch rates. They demonstrated that low levels of pinger deployment could, counter-intuitively, result in an increase in by-catch. Because pingers cause the porpoise to move away from the ensonified area, there is a greater chance of interactions with non-pingered nets. Lusseau, Kindt-Larsen & van Beest (2023) concluded that pingers need to be deployed on at least 30% of the fleet to reduce the by-catch rate.

When considering high porpoise density areas, such as protected sites, banning gillnets will reduce encounters within the site boundaries. However, banning static nets may also produce counter-intuitive results because the fishing effort is not removed, only displaced. Where the displaced fishing vessels are moved to poorer grounds, there will be an increase in fishing effort, potentially leading to an increase in by-catch outside the protected site boundaries (Pinn, Macleod & Tasker, 2021; Lusseau, Kindt-Larsen & van Beest, 2023).

5 | CAN THE PINGER CONUNDRUM BE SOLVED?

Although alternative mitigation measures to pingers or switches to alternative gear types (e.g. potting or Scottish seines) have been proposed and investigated (e.g. Leaper & Calderan, 2018; Read, 2021), none are considered as effective as the use of pingers (van Beest et al., 2017; Hamilton & Baker, 2019; Hoos et al., 2019) and/or have negative impacts on commercial viability (Ryan et al., 2022).

It is essential that any conservation actions and management interventions proposed are proven effective and are practical for fishers to implement. The annual average net profit for all inshore vessels using static nets in 2019 in the UK was approximately £1,000 per vessel (Seafish 2022). Removing the low-activity vessels, the annual average net profit for the 203 active inshore static net vessels increases to £11,000 per vessel (Seafish, 2022). This net profit for active inshore vessels is equivalent to one-quarter of the estimated cost of converting from static nets to a Scottish seine or to pots (Read, 2021). In addition to the cost of switching gear, it will also take time for the fishers to learn and adapt to a new method of fishing, which will impact on catch rates and viability. Any switch in gear will also require the vessel to be re-licensed. Given the combination of costs involved, switching gear is not considered a commercially viable option by inshore static net fishers. Instead, the introduction of effective technical measures that can be adopted without fundamentally changing the fishing operation is preferable (Ryan et al., 2022).

Although some gear modifications are being trialled (e.g. position of net in relation to the surface, net stiffening, net illumination, or acoustically reflective nets; Leaper & Calderan, 2018; Bielli et al., 2020; Kiszka et al., 2021; Kratzer et al., 2021, Kratzer et al., 2022), pingers offer the only technical measure that is readily available, pragmatic, affordable, and proven to mitigate harbour porpoise by-catch in static net fisheries (Hamilton & Baker, 2019). In essence, this means there is a need for a proactive approach to the use of pingers by the inshore static net fleet until such times as effective gear modifications or viable alternatives to pingers become available.

Coincidentally, there needs to be a much stronger acknowledgement from some in the environmental non-governmental organization (eNGO) community and wider society that fishers do not want to catch porpoises or any other protected species. It is the fishers that have to purchase and maintain any required mitigation measures and adapt their fishing practice to facilitate the use of the measures. When by-catch is discussed in wider society, much of the rhetoric and language used does not reflect this. Nor is it conducive to collaborative working, something considered essential for the successful elimination of by-catch (Dolman et al., 2021; Ford & Stewart, 2021; Kemp et al., 2023). The active participation of fishers in governance and management decisions will help with the acceptance of the regulatory regime and the need for compliance through the development of trust and a common language (STECF, 2019; Barz et al., 2020; Bisack & Clay, 2020; de Castro, Broadhurst & Domit, 2021; Psuty & Całkiewicz, 2021). In the UK, this is the type of approach that has begun to develop through Clean Catch UK, a research forum comprising government representatives, regulators, fisheries representatives, academics, and NGOs with the aim of developing industry-led practical and effective solutions to reduce the by-catch of protected species.

Trust is a vital component of fisheries management. The success of any management measure is determined by the willingness of fishers to implement and adhere to the measures. This is influenced by the way the science is communicated, the equity of approach, the complexity of the management measures imposed and, subsequently, the speed of regulatory amendment, when required (Geijer & Read, 2013; McDonald & Rigling-Gallagher, 2015; McDonald, Lewison & Read, 2016; Ford & Stewart, 2021; Kemp et al., 2023). Fishers are interested in the science behind the decision-making, and they want effective, pragmatic, and equitable management.

Many fishers know that pingers present a solution for reducing porpoise by-catch and, consequently, have difficulty understanding why they are not being permitted to use them. Because of the specific requirements for obtaining a Marine Wildlife Licence (e.g. detailing the exact position and timing for the deployment of pingers), the UK licensing approach is not facilitating pinger use in the inshore fisheries where mitigation would be beneficial. Licensing the use of pingers is peculiar to the UK, with other countries adopting a range of different approaches. In Denmark, fishers can purchase and use pingers if they want to do so (L. Kindt-Larsen, pers. com., 14 February 2023), whereas in the Netherlands and Finland the voluntary use of pingers has been facilitated for vessels outside the original scope of EU Regulation 812/2004 (Scheidat, Couperus & Siemensma, 2018; ICES, 2020b). In Poland, the use of pingers by small inshore vessels has been facilitated by eNGOs (ICES, 2020b), whereas Norway has introduced the Pinger Mandate 2020 (Moan & Bjørge, 2021). From 1 January 2023, this mandate required over 5,000 coastal gillnet vessels to use pingers, and was introduced to enable the continuation of fisheries exports to the USA. Through the Marine Mammal Protection Act (n.d.), by-catch mitigation requirements equivalent to those imposed on US domestic fisheries are now applicable to all imported fishery products.

For the UK, one possible solution within the current legislative framework would be for the regional inshore fisheries management organizations to hold the licence for pinger use within their management area. One advantage of this approach is that the fisheries management organizations also have responsibility for fisheries measures in the coastal marine protected areas (MPAs). This approach could be trialled in several of the inshore areas with a recognized by-catch issue. For example, Devon and Severn Inshore Fisheries and Conservation Authority (IFCA) is responsible for fisheries management in the Bristol

Channel, the Southern IFCA and Sussex IFCA are responsible for fisheries management in the inshore west and east English Channel, respectively, and the Kent and Essex IFCA and Eastern IFCA are responsible for fisheries management in the inshore southern North Sea.

The IFCAs can use voluntary agreements, or by-laws if required, to enable the use of pingers in fisheries with a known harbour porpoise by-catch issue. This has the advantage of constraining pinger use both spatially and temporally, helping to alleviate conservation concerns regarding the displacement of porpoises or potential impacts on protected sites. Concerns have also been raised regarding the correct spacing and pinger functionality affecting the reduction of by-catch rates in commercial fisheries (Mackay & Knuckey, 2013; Coram & Northridge, 2018; STECF, 2019). The IFCAs are already responsible for fisheries enforcement and, therefore, in a position to ensure correct deployment. If the IFCAs had responsibility for the pool of pingers available for use by fishers, then there is also the opportunity to ensure the maintenance and functionality of the devices over the longer term.

Without a significant change in the approaches to by-catch mitigation in the UK, it is unlikely that any further reduction in harbour porpoise by-catch will be achieved in the near future. With the dynamic nature of both harbour porpoises and many fisheries, predicting when by-catch will occur is difficult. Making use of fishers' knowledge and their willingness to implement measures in small-scale local fisheries will help focus effort where needed. Finding workable and effective solutions is essential if the long-term goal of eliminating protected species by-catch is to be achieved. This is all the more important with, for example, the introduction of the new Marine Stewardship Council Fisheries Standard for certifying sustainability. The standard now requires fisheries to demonstrate how they are reducing impacts on protected species through the application of best practice management measures (MSC, 2022). Until proven alternatives are available, facilitating the use of pingers in the inshore fisheries with a high by-catch risk provides the only practical option for further reducing the incidence of harbour porpoise by-catch in UK static net fisheries.

ACKNOWLEDGEMENTS

Thanks to Prof. John Baxter and two anonymous reviewers, whose comments greatly improved this article.

CONFLICT OF INTEREST STATEMENT

The author declares no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

ORCID

Eunice H. Pinn https://orcid.org/0000-0002-7604-331X

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How to cite this article: Pinn, E.H. (2023). Porpoises, by-catch and the 'pinger' conundrum. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 33(11), 1360–1368. https://doi.org/10.1002/aqc.4004