Fixed Gill Nets Interactions with Harbour Porpoise

1. Introduction

The Assessing Welsh Fishing Activities (AWFA) Project is a structured risk-based approach to determining impacts from current and potential fishing activities (those undertaken from licensed and registered commercial fishing vessels), upon the features of European marine sites (EMS) in Wales.

Further details of the AWFA Project, and all completed assessments to date, can be found on the AWFA website.

The methods and process used to classify the risk of interactions between fishing gears and EMS features, as purple (high), orange (medium) or green (low) risk, can be found in the AWFA Project Phase 1 outputs: Principles and Prioritisation Report and resulting Matrix spreadsheet.

2. Assessment summary

Assessment Summary: **Fixed Gill Nets** **Interactions with Harbour** **Porpoise**	Direct and indirect studies that directly measured or estimated impacts of fixed gill net and other fixed net fisheries on harbour porpoise were considered. **<u>Assessment of impact pathway 1: Direct capture, damage, disturbance or harm to a designated species feature:</u>** The impacts from fixed gill nets or noise pollution associated with fishing vessels could lead to harbour porpoise bycatch, displacement or disturbance. **<u>Assessment of impact pathway 2: Damage to the habitat of designated species features (including through direct physical impact, pollution, changes in thermal regime, hydrodynamics, light etc.):</u>** The impacts from fixed gill nets, weights or anchors are not likely to affect the integrity of the water column habitats utilised by harbour porpoise (see Impact Pathway 4 for prey habitat considerations). **<u>Assessment of impact pathway 3: Removal of prey species of a designated species feature:</u>**

	The removal of prey species by fixed gill nets could affect harbour porpoise. Evidence suggests that harbour porpoise may readily switch prey, but it is not known if dependency on alternative prey availability and quality is detrimental at the population level in the long term. **Assessment of impact pathway 4: Damage to habitat of prey species:** The impacts from fixed gill nets, weights or anchors could damage the habitat of the prey species of harbour porpoise, the extent of which is dependent on the intensity of the activity. Confidence in this assessment is **high** (please see section 8).

3. Feature description

Feature Description: **Harbour Porpoise**	Harbour porpoise (*Phocoena phocoena*) is the smallest species of cetacean found in European waters measuring around 1.3-1.5m in length and weighing 50-60kg (Bjørge and Tolley, 2002). Harbour porpoise is a widespread and wide-ranging species, common to coastal areas of the European continental shelf, and seen throughout the year (SCANS II, 2008; Hammond *et al*., 2017; Rogan *et al*., 2018). Within a UK context harbour porpoise have been recorded around all coasts of Britain and Ireland (Hammond *et al*., 2017; Rogan *et al*., 2018; Russel, 2006). Harbour porpoise display considerable inter-annual variation in their movements and distribution (Smith *et al*., 1993), possibly influenced by prey location and environmental conditions such as water quality and temperature (Heinänen and Skov, 2015). Three offshore Welsh Special Areas of Conservation (SAC) have been designated around Wales specifically for their importance to harbour porpoise populations, these are North Anglesey Marine / Gogledd Môn Forol, Bristol Channel Approaches / Dynesfeydd Môr Hafren and West Wales Marine / Gorllewin Cymru Forol (JNCC and NRW, 2016a, b, c). Harbour porpoise feed primarily on fish but have also been recorded to prey on squid and crustaceans (Santos and Pierce, 2003; Santos *et al*., 2004, 2005; IAMMWG, 2015). Small pelagic schooling fishes with high lipid content such as herring, sprat and anchovy and a range of bottom-dwelling fishes such as sand-eel and gobies are common prey species (Bjørge and Tolley, 2002). After a gestation period of about 10-11 months, harbour porpoise give birth to calves between May and August with a peak in June (Read, 1990; Sorensen and Kinze, 1994). Porpoise nurse their calves for up to 12 months (Møhl-Hansen, 1954; Read, 1990) and the mother usually reproduces every 1-2 years (Bjørge and Tolley, 2002).

4. Gear description

Gear Description: **Fixed Gill Nets**	Fixed, set or anchored gill nets comprise a single taught wall of transparent monofilament or multifilament netting, hung from an upper floated headline and attached to a weighted lower footrope, ensuring they hang approximately vertically in the water, and the bottom of the net sits on or near the seabed (Potter and Pawson, 1991; FAO, 2019; Seafish, 2019). Fixed gill nets are attached to the seabed at each end by conventional anchors or weights, thus preventing movement with the tide, and nets are marked at one or both ends with buoys (Potter and Pawson, 1991; Seafish, 2019). Although gill nets can be deployed in midwater, near the surface or demersally depending on design, buoyancy and target species (FAO, 2019), in the UK they are typically deployed on or just above the seabed (Seafish, 2019) and therefore the focus of this assessment is bottom-set fixed gill nets. Fixed gill nets enmesh fishes that swim into them, usually catching behind the gill plate (gill-held), or around the widest point of body (wedge-held) (He, 2006; Kalaycı and Yeşilçiçek, 2012). The taught nature of gill nets means they have a higher degree of size (and therefore species) selectivity, compared to entangling and trammel nets (FAO, 2019). Target sizes are regulated by using different mesh sizes and adjusting the net hanging ratio, which changes how stretched the net is between the framing ropes, and therefore modifying the shape of the mesh openings (Potter and Pawson, 1991; He, 2006). The use of net haulers is common on larger vessels hauling longer fleets of nets, often measuring several kilometres and/or nets set at greater depths (FAO, 2019). In small-scale inshore fisheries, as is common in Wales, individual gill nets typically measuring a few hundred metres, and set in shallow or moderate depth water, could be hauled by hand or by net hauler. With all fixed net fisheries, a variety of international and national regulations and local factors determine the mesh size, length, and height of nets used, including areas fished and target species (NOAA, 2019). Relevant to Wales, EU and Welsh Government regulations determine mesh sizes, net lengths, soak times, and areas in which they can be deployed (Welsh Government, 2011a and 2011b; European Council, 2013).

5. Assessment of impact pathways

Assessment of impact pathway 1	**1. Direct capture, damage, disturbance or harm to a designated species feature** Direct evidence was found that measured or estimated some impacts of fixed gill nets on harbour porpoise. Additionally, indirect evidence on the impacts from other fixed net fisheries on the direct capture, damage, disturbance or harm of harbour porpoise and similar species is also considered. In 2007 and 2013, the UK status of harbour porpoise was reported as favourable (JNCC, 2007, 2013). The distribution of harbour porpoise overlaps with fixed net fishing activity predominantly by under 12m vessels within Welsh inshore waters (0-12NM), potentially leading to bycatch interactions through entanglement via their teeth, beak, fins or tail (; Evans and Hintner, 2012; Baines and Evans, 2012; Jefferson and Curry, 1994). The feeding behaviour of the harbour porpoise on or near the seabed increases the possibility of interaction with bottom set nets such as fixed gill nets (Bjørge, 2003; Evans and Hintner, 2012). The UK Cetacean Strandings Investigation Programme (CSIP) has continuously recorded harbour porpoise strandings around the UK since 1990 (Deaville and Jepson, 2011). The CSIP undertook 478 postmortems of stranded harbour porpoise from throughout the UK between 2005 and 2010. Bycatch by unspecified fishing gear was the 4th prominent cause of death and accounted for 15% of the postmortems (Deaville and Jepson, 2011). A more recent study analysed 25 years of harbour porpoise strandings data from the West coast of the UK and found that the most common direct anthropogenic cause of death was fisheries bycatch (gear unspecified) (ten Doeschate *et al.,* 2019). Between 2010 and 2017, 6,292 observed hauls resulted in the bycatch of 96 harbour porpoise within UK fixed net fisheries (excludes drift nets) where pingers were not used, whilst only 2 harbour porpoise were observed in 705 observed hauls (4km nets or smaller) where pingers were used (Northridge *et al*., 2018). This observed fishing effort included five fixed net categories: hake gillnets, light gillnets, light-flatfish gillnets, standard gillnets and combined ‘fixed entangling and trammel nets'). Amongst these, ‘fixed entangling and trammel nets' metier contributed the greatest proportion of bycatch between 2010 and 2017, totalling 66 porpoise in 3,369 hauls, approximately double the bycatch rate (animal per haul) of the other combined gill net categories (30 porpoise in 2923 hauls). This lower bycatch rate from the combined UK gill net categories suggests these fishing methods could potentially pose a lesser risk to harbour porpoise compared to the larger-meshed entangling and trammel net fisheries in the UK (Northridge *et al*., 2018). Harbour porpoise locate fish and navigate using echolocation and are thought to be capable of detecting mono and multifilament bottom set gill nets from 3-6m in quiet conditions, and when approaching the net in a perpendicular direction (Kastelein *et al*., 2000). This distance was thought to be lower when approaching from other angles, in noisier conditions, or where the porpoise might be distracted by movements of fish already

	caught in the net. This short detection distance was not thought sufficient to allow harbour porpoise time to react when approaching a fixed net, and this increases the likelihood of entrapment (Kastelein *et al*., 2000). Mesh size, twine diameter, net height and water depth were identified as significant factors affecting bycatch rates of harbour porpoise in fixed nets (Northridge *et al*., 2013; Mackay, 2011) and these factors were considered important for future research as potential mitigation measures (Wiedenfeld *et al*., 2015; Northridge *et al*., 2017). Orphanides (2009) and Mackay (2011) demonstrated greater bycatch of harbour porpoise with increases in mesh size in fixed net fisheries in the USA and UK respectively. Mesh size and twine thickness are usually dependent variables, with larger mesh sizes also having thicker diameter twine (Mackay, 2011). Northridge *et al*. (2003) demonstrated fixed nets with a thicker twine diameter (0.6mm) resulted in a significantly higher harbour porpoise bycatch rate, compared to thinner (0.4mm) twine. They hypothesized the thinner twine was easier to break by seals and porpoise caught in the nets, a theory substantiated by a greater number of holes in the thinner twine nets (Northridge *et al*., 2013). Kastelein *et al*. (2000) reported harbour porpoises' ability to detect different types of bottom set gill nets was not affected greatly by mesh size. They hypothesized the reason for this, related to the size and number of knots within the nets. Smaller mesh-nets tend to have thinner twine but a greater density of knots which provided stronger return echolocation signals, whereas larger mesh sizes had fewer knots but thicker twine, also providing good return echoes. Both variations had a similar effect on the detectability of the net by the bottlenose dolphin regardless of physical differences (Kastelein *et al*., 2000). However, it should be noted that ability to detect nets was not linked to bycatch rates in this study. Fixed structures in the sea could act as barriers or deterrents, causing possible displacement or change in behaviour of harbour porpoise from an otherwise suitable habitat (Shane *et al*., 1986; Markowitz, 2004). The operation of fixed nets is usually temporary, however, depending on the location and amount of fixed netting the activity could potentially cause barrier or deterrent effects. Regarding the height of bottom set gill nets, Trippel *et al*. (1999) reported 96% of observed porpoise bycatch in 1994, in the Bay of Fundy (Canada), were caught in the top two thirds of the gill nets. Mackay (2011) and He (2006) suggests setting the gill net headrope lower in the water might reduce porpoise bycatch in certain groundfish fisheries. A study by He (2006) reported a greater species-selectivity with no loss of target species (flounder) catches when reducing the gill net standing height from 25 meshes deep to 8 or 12 meshes deep. Evans and Hintner (2012) describe several studies reporting a disproportionate number of juvenile porpoises in German and Dutch gill net fisheries in the Baltic and North Sea (such as Clausen and Andersen, 1988; Kinze, 1990, and Kock and Benke, 1996). They suggest avoidance of nets could be a learned response, therefore resulting in higher numbers of inexperienced juveniles becoming entangled in nets. Similarly, Read and Hohn (1999) describe researchers reporting a bias towards the capture of younger individuals in gill net fisheries in California and Danish waters (e.g. Hohn and Brownell,1990, and Kinze,1990). Vishnyakova & Gol'din (2015) suggested peaks in juvenile strandings and gill net-bycaught harbour porpoise in the Sea of Azov and Black Sea

	were primarily due to seasonal nutritional stress in summer caused by calving and nursing and independent foraging by recently weaned yearlings (juveniles). They suggested these nutritionally stressed (hungrier) porpoises exhibited riskier foraging behaviour near gill nets, and this resulted in greater incidents of entrapment. However, during an examination of 239 gill-net caught harbour porpoise from the Gulf of Maine and Bay of Fundy (Canada) in Summer and Autumn (1989-1993), Read and Hohn (1990) concluded no difference in mortality between age classes in the samples they examined. There seems to be disagreement amongst researchers whether juveniles are at greater risk from fixed nets compared with adult harbour porpoise. Such discrepancies suggest there is more to learn about harbour porpoise bycatch, and that seasonal and geographic variability in bycatch rates might well play important roles in different porpoise populations. In order to deter harbour porpoise, Regulation (EU) 2019/1241 (European Union, 2019) requires vessels of 12m of larger, in certain areas (excluding the Irish Sea - ICES area 7a), to use active acoustic deterrent devices emitting high-frequency pulsed sounds (pingers) on specified fishing gears. Pingers effectively reduce the number of harbour porpoise casualties in bottom set gill nets (Trippel *et al.,* 1999; Northridge *et al*., 2018). Culik *et al*. (2001) reported effective exclusion of harbour porpoise to areas where pingers were used, whilst no change to the catch per unit of effort of herring (a favoured porpoise prey species), suggesting herring were not affected by pingers. Northridge *et al*. (2018) calculated the harbour porpoise bycatch rate in observed fixed net fisheries between 2008-17 to be 83% lower when pingers were used, compared to observed fishing effort where pingers were not required or used. Using bycatch observation figures, Northridge *et al.* (2018) estimated bycatch of harbour porpoise for all UK fixed net fisheries to range between 1098 (with pingers) and 1282 (without pingers) in 2017. Further bycatch estimates focusing on areas relevant to Wales (but not exclusively Welsh), Northridge *et al.* (2014, 2015, 2016) estimated the average harbour porpoise bycatch for the years 2014, 2015 and 2016, assuming full compliance with pinger use, ranged from 27-33 for ICES divisions 7a (Irish Sea), 263-335 for ICES area 7f (Bristol Channel) and 15-41 for ICES area 7g (Celtic Sea North). Pingers are effective at deterring harbour porpoise from the proximity of fishing nets. Depending on the number of pingers used, their extent and frequency of installation along the net, they also have the potential to exclude harbour porpoise from important foraging areas for extended periods of time. Van Beest *et al*. (2017) modelled harbour porpoise population effects in Danish waters where gill nets employed pingers to reduce porpoise bycatch. Their modelling study suggested widespread pinger use caused noise-avoidance behaviour that negatively affected individual survival and resulted in reduced population levels. However, when combining pinger use with time-area fishing closures, the modelled negative sublethal avoidance effects were cancelled out at the population level (van Beest *et al*., 2017). Activities that produce underwater noise have the potential to disturb harbour porpoise. Commercial fishing contributes to ambient noise in a number of ways, including low frequency sound from engines and gear

	winching and hauling, and high frequency sound from the use of sonar and fish finding equipment (Evans and Hintner, 2012). Dyndo *et al*. (2015) reported captive harbour porpoise demonstrating predictable behavioural responses to high frequency components of vessel noise at distances exceeding 1000m. They suggested that vessel noise is a largely overlooked but could be a substantial source of disturbance to harbour porpoises in inshore areas. Wiśniewska *et al*. (2018) demonstrated negative disturbance effects including aborted foraging and cessation of echolocation, in wild harbour porpoises, when exposed to high levels of shipping and boat noise. Depending on the fishery, the operation of the gear and the intensity of the activity it is possible that the impacts from fixed gill nets or noise pollution associated with fishing vessels could lead to harbour porpoise bycatch and, displacement/disturbance respectively.
Assessment of impact **pathway 2**	**2. Damage to the habitat of designated species features (including through direct physical impact, pollution, changes in thermal regime, hydrodynamics, light etc.)** No studies were found that directly measured or estimated the impacts of fixed gill nets on the habitat utilised by harbour porpoise. Therefore, indirect evidence on the impacts from other fixed nets on the habitats utilised by harbour porpoise is considered. Harbour porpoise distribution, habitat preference and responses to environmental conditions are all highly variable (Marubini *et al*., 2009; Isojunno *et al*., 2012), representing a considerable challenge for surveying and monitoring population levels, and spatial management for conservation purposes (Evans *et al*., 2010; NRW and JNCC, 2017). Habitat preference by harbour porpoise is thought to be driven by factors such as the distribution and availability of their various prey species (NRW and JNCC, 2017). In several modelling studies (e.g. Marubini *et al*., 2009; Embling *et al*., 2010 & Heinänen and Skov, 2015), where primary data on prey species distribution is scarce or absent, relationships between prey distribution and quantifiable habitat variables (e.g. depth, water temperature, seabed sediment type), were used as proxies for prey distribution (NRW and JNCC, 2017). Heinänen and Skov (2015) developed distribution models using relationships between environmental variables and areas of observed high harbour porpoise densities to predict areas of persistently high harbour porpoise density. The model suggests the distribution of harbour porpoise are influenced by oceanographic, seabed habitat and anthropogenic (shipping intensity) factors, and these factors vary slightly seasonally and spatially around the UK. Heinänen and Skov (2015) predicted greater harbour porpoise habitat preference for areas of coarser sediments, such as sands and gravels, compared to finer sediments such as mud. The interaction between fixed gill nets and the benthic habitats of harbour porpoise prey is considered in Impact Pathway 4.

	Harbour porpoise activities, other than benthic feeding, tend to occur within the water column and are not known to be dependent on the seabed habitat. The impacts from fixed gill nets, weights or anchors are not likely to affect the integrity of the water column habitats utilised by harbour porpoise.
Assessment of impact **pathway 3**	**3. Removal of prey species of a designated species feature** No studies were found that directly measured or estimated the impacts of fixed gill nets removing the prey species of harbour porpoise. Therefore, indirect evidence from other fisheries catching the prey of harbour porpoise can be considered. Competition is likely to occur between commercial fishing activities and foraging harbour porpoise (Tregenza *et al*., 1997; Walmsley and Pawson, 2007). Evidence indicates harbour porpoise target some of the same species that fixed gill net fisheries target such as juvenile demersal fish (Santos and Pierce, 2003). However, harbour porpoise, in common with other small marine mammal species that switch diets and feed in ecosystems where the choice of prey is varied, are less likely to be dramatically affected by fishing impacts on their prey species (Hutchinson, 1996; Jennings *et al*., 2001). UK inshore fixed gill net fisheries target demersal species such as cod, pollack, dogfish (catsharks), haddock, hake, megrims, monkfish and skates (Seafish, 2019). In Wales, fixed gill nets are used to target cod, whiting, pollack, bass and dogfish (catsharks) with mesh sizes of 120-160mm and to a lesser extent herring and mullet (Walmsley and Pawson, 2007). Tregenza *et al.* (1997) observed catches of hake, pollack, saithe, ling and cod in the UK and Irish fixed gill net hake fishery in continental shelf waters of the Celtic Sea between 1992-94. Some of these fish species are also prey species for harbour porpoise, and therefore some competition is likely to occur between commercial fishing activities and foraging harbour porpoise (Santos and Pierce, 2003). Harbour porpoise may spend time foraging for a preferred prey species before switching to the most locally abundant species (Santos and Pierce, 2003). Wiśniewska *et al*. (2016) demonstrated harbour porpoise targeting and eating small 3-10cm fish but the small sample size of this study is slightly biased towards juvenile harbour porpoise and not representative of the entire population (Hoekendijk *et al*., 2018). The Maximum Sustainable Yield (MSY) for a fish stock is the maximum level at which a fish stock can be routinely exploited without long-term depletion. In the pursuit of MSY for fish stocks, the International Council for the Exploration of the Seas (ICES) incorporates both fishing and natural fish mortality in their stock assessment models and Total Allowable Catch (TAC) advice. Natural mortality is defined as “all sources of mortality of a fish stock outside of that caused by fishing” (Walmsley, 2018). Specifically, this includes predation by other fish, birds and marine mammals, and mortality from biotic and abiotic factors such as temperature, disease and other anthropogenic activities, excluding fishing (Walmsley, 2018).

	ICES have recently developed a multi-species model for the North Sea, including cod, haddock, herring, whiting, sprat, Norway pout and sandeel (Walmsley, 2018). A similar multi-species assessment model is being developed for the Irish Sea. This complex multi-species approach specifically incorporates predator prey interactions (Walmsley, 2018) e.g. foraging harbour porpoise, and reflects changes in abundance of different ecosystem components. Better estimates of natural mortality should lead to more realistic TAC advice, improved fisheries management in line with MSY and adequate allocation of food resources to predator species such as harbour porpoise. However, importantly, it should be noted that commercially fished non-TAC species forming part of the diet of harbour porpoise would not be subject to the same stock assessments. Depending on the intensity of fishing activity, it is possible that the removal of prey species by fixed gill nets could affect harbour porpoise. However, evidence suggests that harbour porpoise may readily switch prey, but it is not known if dependency on alternative prey availability and quality is detrimental at the population level in the long term.
Assessment of impact **pathway 4**	**4. Damage to habitat of prey species** No studies were found that directly measured or estimated the impacts of fixed gill nets on the habitats of prey species of harbour porpoise. Therefore, indirect evidence on the impacts from other fixed net fisheries on the habitats utilised by harbour porpoise prey species is considered. Prey species of harbour porpoise include (but are not limited to) a variety of small demersal and pelagic fish (3-30cm in length) including cod, flatfish, haddock, hake, mullet, pollock, saithe, sandeels, sprat, whiting and to a lesser extent cephalopods and other shellfish (Hutchinson, 1996; Jennings *et al*., 2001). The habitat of these prey species varies but can be broadly characterised as pelagic and benthic habitats including sediments such as sands and gravels, seagrass beds and reefs. Habitat preference by harbour porpoise is thought to be driven by factors such as the distribution and availability of their various prey species (NRW and JNCC, 2017). In several modelling studies (e.g. Marubini *et al*., 2009; Embling *et al*., 2010 & Heinänen and Skov, 2015), where primary data on prey species distribution is scarce or absent, relationships between prey distribution and quantifiable habitat variables (e.g. depth, water temperature, seabed sediment type), were used as proxies for prey distribution (NRW and JNCC, 2017). Heinänen and Skov (2015) developed distribution models using relationships between environmental variables and areas of observed high harbour porpoise densities to predict areas of persistently high harbour porpoise density. The model suggests the distribution of harbour porpoise are influenced by oceanographic, seabed habitat and anthropogenic (shipping intensity) factors, and these factors vary slightly seasonally and spatially around the UK. Heinänen and Skov (2015) predicted greater harbour porpoise habitat preference for areas of coarser sediments, such as sands and gravels, compared to finer sediments such as mud. Sedimentary habitats, located in bays include sandbanks, and in more sheltered environments, seagrass beds. These are

	considered important habitat and nursery areas for various demersal and pelagic fish species (Bertelli and Unsworth, 2014), many of which are prey species for harbour porpoise. Anchors and weights, distributed along the foot rope of fixed gill nets, have the potential to penetrate finer sediments including sands and gravels, and nets set in higher-energy environments may cause greater abrasion to the seabed due to the increased tidal forces acting on the nets. In sand and gravel habitats the mobile and dynamic nature of the seabed (Hinz *et al*., 2010a & 2010b; JNCC, 2017) combined with the relatively small footprint of fixed net anchors, the short soak times of the nets measured in hours (Northridge *et al*., 2017) all suggest that any seabed disturbances from anchors and weights are likely to recover over short periods of time, such as weeks (Hinz *et al*., 2010a & 2010b). Reef habitats are potentially at risk of abrasion or crushing by fixed net anchors or weights, nets can also become entangled on seabed structures causing fragmentation, tearing or abrasion of the habitat, leading to deterioration and the removal of long-lived fragile and emergent epifauna (Brown and Macfadyen, 2007). However, most fishers with nets tend to avoid reef habitats to prevent losing or damaging their nets, and so the risk to these habitats may be lower than anticipated. Factors affecting the integrity of pelagic fish habitats e.g. water quality are not likely to be affected by fishing with fixed gill nets. These factors are not considered further in this assessment. Depending on the footprint and the intensity of the activity it is possible the impacts from nets, weights or anchors could damage the benthic habitats of the prey species of harbour porpoise. However, these are large scale habitat features and there is no evidence to suggest that the impacts from fixed net fisheries on the habitats of harbour porpoise prey species would affect the harbour porpoise at a population level.

6. SACs designated for harbour porpoise

Harbour porpoise are listed as protected species in three SACs in Welsh waters, but due to their mobile nature, impacts from activities must be considered throughout their wider management unit.

Bristol Channel Approaches SAC	The analyses of Heinänen and Skov (2015) predicts harbour porpoise occur in persistent high densities throughout the site, and at an elevated density during winter months (JNCC, 2015). Harbour porpoise were assessed to be in favourable conservation status (FCS) at the UK level in the 2013 Article 17 report. At the time of SAC designation (Feb. 2019) it was assumed that the sites, which contribute to FCS, had features in favourable condition. However, the harbour porpoise have since been assessed as unknown - FCS in the most recent (post-designation) 2019 Article 17 report (JNCC, 2019).
West Wales Marine SAC	Seasonal differences in the relative use of the site have been identified based on the models and predictions of Heinänen and Skov (2015), indicating harbour porpoise occur in elevated persistent densities throughout the site in summer and in a part of the site, (Cardigan Bay), during winter months (NRW and JNCC, 2015). Harbour porpoise were assessed to be in favourable conservation status (FCS) at the UK level in the 2013 Article 17 report. At the time of SAC designation (Feb. 2019) it was assumed that the sites, which contribute to FCS, had features in favourable condition. However, the harbour porpoise have since been assessed as unknown - FCS in the most recent (post-designation) 2019 Article 17 report (JNCC, 2019).
North Anglesey Marine SAC	The analyses of Heinänen and Skov (2015) predicts harbour porpoise occur in persistent high densities throughout the site, and at an elevated density during summer months (JNCC and NRW, 2017). Harbour porpoise were assessed to be in favourable conservation status (FCS) at the UK level in the 2013 Article 17 report. At the time of SAC designation (Feb. 2019) it was assumed that the sites, which contribute to FCS, had features in favourable condition. However, the harbour porpoise have since been assessed as unknown - FCS in the most recent (post-designation) 2019 Article 17 report (JNCC, 2019).

7. Evidence Gaps

- Direct studies to measure the impacts from fixed entangling nets on harbour porpoise
- Studies to measure noise pollution of Welsh fishing fleet on harbour porpoise
- Studies to measure behaviour change of harbour porpoise towards pingers
- Monitoring of harbour porpoise population status
- Direct studies on the impact of mesh size, twine diameter, net height and water depth on harbour porpoise bycatch

8. Confidence assessment

The confidence score is the sum of scores from three evidence components: quality, applicability and agreement. These are qualitatively assessed as high, medium or low using the most appropriate statements in the table below, and these are numerically represented as scores of 3, 2, or 1 respectively.

A total confidence score of 3 – 4 represents low confidence, 5 – 7 shows medium confidence and 8 – 9 demonstrates high confidence in the evidence used in the assessment.

This assessment scores 8, representing high confidence in the evidence.

	Evidence quality	Evidence applicability	Evidence agreement
High	**Based on more than 3 recent and relevant peer reviewed papers or grey literature from established agencies.** **Score 3.**	Based on the fishing gear acting on the feature in the UK.	**Strong agreement between multiple (>3) evidence sources.** **Score 3.**
Medium	Based on either relevant but older peer reviewed papers or grey literature from less established agencies; or based on only 2-3 recent and relevant peer reviewed evidence sources.	**Based on similar fishing gears, or other activities with a similar impact, acting on the feature in the UK.** **Score 2.**	Some disagreement but majority of evidence agrees. Or fewer than 3 evidence sources used.
Low	Based on either less relevant or older grey literature from less established agencies; or based on only 1 recent and relevant peer reviewed evidence source.	Based on dissimilar fishing gears acting upon the feature in other areas.	Little agreement between evidence.

N.B. When evidence is indirect the evidence quality and applicability will be capped to medium, to ensure that direct evidence gaps are captured in this approach.

9. References

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