Assessment of maximum effective spacing for acoustic deterrents deployed in gill net fisheries in the Celtic Sea

Final Report

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Summary

EC Regulation No. 812/2004 requires the use of active acoustic harbour porpoise (*Phocoena phocoena*) deterrents or pingers on bottom-set nets. The recommended maximum spacing for some pinger models is 200m but the maximum effective spacing may be greater than this.

This study aimed to field test the effective range of two models of pingers, the Aquatec AQUAmark 100 and the Fumunda FMDP 2000 by deploying them at various spacings along bottom set gillnets in commercial fisheries where porpoise by-catches are known to occur. A total of 152 relevant hauls measuring a total of 637km were observed in the Celtic Sea between May 2005 and June 2007. Pingers were placed on nets spaced at 200m and 600m and nets with no pingers were also deployed as control stations.

The AQUAmark 100 pingers worked well during the trials. However problems were encountered with a specific batch of pingers received from Fumunda which began to disintegrate and ceased to function soon after they were deployed.

A total of 7 harbour porpoises were observed as by-catch, 5 in control nets with no pingers attached and 2 in nets with Fumundas which were not operating correctly. No porpoises were caught in any nets with Aquamark pingers at either 200 or 600m spacing.

The Danish Institute for Fisheries Research (DIFRES) carried out a similar pinger spacing experiment with Aquamark pingers in the North Sea from July to September 2006 which resulted in significant reductions in porpoise by-catch of 100% for nets with 455m spacing and 78% for nets with 585m spacing. A 78% reduction in porpoise by-catch in Irish gillnet fisheries in the Celtic Sea would result in a total estimated by-catch of 95 animals for the entire fleet. This equates to 0.12 % of the Celtic Sea harbour porpoise population abundance estimate which is a small fraction of current thresholds of acceptable by-catch. It is recommended that fishermen should therefore be permitted to use pingers at a spacing of approximately 585m on gillnets in the Celtic Sea.

Introduction

European Council Regulation No. 812/2004 lays down measures concerning incidental catches of cetaceans within certain EU waters. The regulation specifies areas in which all vessels, 12m or over (overall length), are prohibited from using any bottom set gill net, entangling net or drift net without simultaneously using active acoustic deterrents or pingers. The Irish vessels affected by the regulation are those deploying bottom set gill nets or entangling (tangle) nets of any mesh size in ICES divisions VII e, f, g, h, and j.

During 2005 BIM and the Irish South and East Fish Producers Organisation (ISEFPO) conducted an assessment of commercially available pingers on board vessels targeting cod, hake, anglerfish and turbot in the Celtic Sea (Cosgrove et al, 2006). Trials were carried out in various commercial set net fisheries in order to assess the practicalities of deploying each model. In April 2006 BIM staff presented their findings at a meeting in Denmark attended by delegates from other European Institutes and a representative from the European Commission. At the meeting it was pointed out that the general content of the EC regulation would not be subject to review but that it may be possible to modify certain items in the technical annex. Annex II refers to maximum spacing of pingers permitted on nets based on manufacturer recommendations and technical characteristics. Maximum effective spacing of pingers had however not been established when the regulation was issued. A higher maximum spacing would reduce the number of pingers required and therefore reduce the cost of implementing the regulation. BIM therefore initiated fishing trials onboard vessels deploying gillnets to test pinger spacing.

Methods

Two vessels, the 20m wooden hull MFV Girl Geraldine from Dunmore East in the south east and the 22m steel MFV Holly B from Dingle in the south west participated in the trial. Fishing was carried out predominantly in ICES area VIIg but also in VIIj and VIIIb in water depths between 70 and 128m. The vessels targeted hake (*Merluccius merluccius*) and cod (*Gadus morhua*) as part of normal fishing operations. Monofilament gillnets of 0.6mm diameter, with 120mm mesh size and 45 to 60 meshes net height for hake, and 160mm mesh size and 30 meshes in height used for cod. Fully rigged strings of gillnets varied from 18 to 24 individual sheets of approximately 200m in length with an average total length per string/station of 4.19 km (S.E. 0.08, 95% C.I 4.03 – 4.35) . Short lengths (approximately 500m) of 120mm gillnet were in addition set opportunistically over wrecks for white pollack (*Pollachius pollachius*) and black pollack (*Pollachius virens*). No pingers were attached and these nets were not included in pinger spacing analysis. They were however included in comparisons of cetacean by-catch with other studies (Cosgrove and Browne, 2007). Nets were generally deployed in an east – west direction, at night and hauled back during the day, with an average soak time of 18.5 hours.

Pingers were attached to the gear using methods developed in earlier trials aimed at improving pinger durability. One metre lengths of doubled 8mm polypropylene rope were lashed to each end of individual pingers using mounting twine. Two gillnet floats

were threaded on to the polypropylene rope so as to lie either side of the pinger. The pinger and floats were covered with a nylon mesh sock or bait bag, secured at both ends with mounting twine and secured in the join between individual sheets. Aquamark 100 pingers which have a recommended spacing of 200m and Fumunda pingers which have a recommended spacing of 100m were used in the trial. Pingers were spaced on the gear at 200m and 600m on individual stations and deployed along with nets deployed in the same general area at the same time with no pingers attached which were controls. The distances between adjacent nets were at least equal to the maximum pinger spacings to ensure that stations did not affect each other.

The Fumunda pingers began disintegrating after a number of deployments. Acoustic testing was not carried out at sea so it was not possible to determine exactly when these pingers ceased emitting deterrent signals. It was therefore not possible to directly include the Fumundas in the spacing analysis. However due to relatively low levels of cetacean by-catch in the overall experiment, and a number of incidences of cetacean by-catch in nets with Fumundas attached, it was assumed for the purposes of this study that the Fumundas did not work as deterrents. A total of 18 stations with Fumundas were therefore included as control deployments in the spacing trials in order to improve the power of statistical analysis. In addition 7 validated control hauls from the pinger practicality trials in 2005 where cetacean by-catch occurred were also added to the dataset.

A two sided Fisher's exact chi squared test which is suitable for analysis of categorical data where sample sizes are small was used to determine if by-catch rates between groups of stations were significantly different from each other. A Students t-test based on unequal variance was used to determine if catch rates of whitefish differed between stations with and without pingers.

Results

Table 1. Details of pinger deployment and porpoise by-catch *(Fumunda as control pooled with 2005 data)*

	Pinger Spacing			
No. Stations	Control	200m	600m	Totals
Aquamark 100				
Without by-catch	96	22	27	145
With by-catch	7	0	0	7
				152

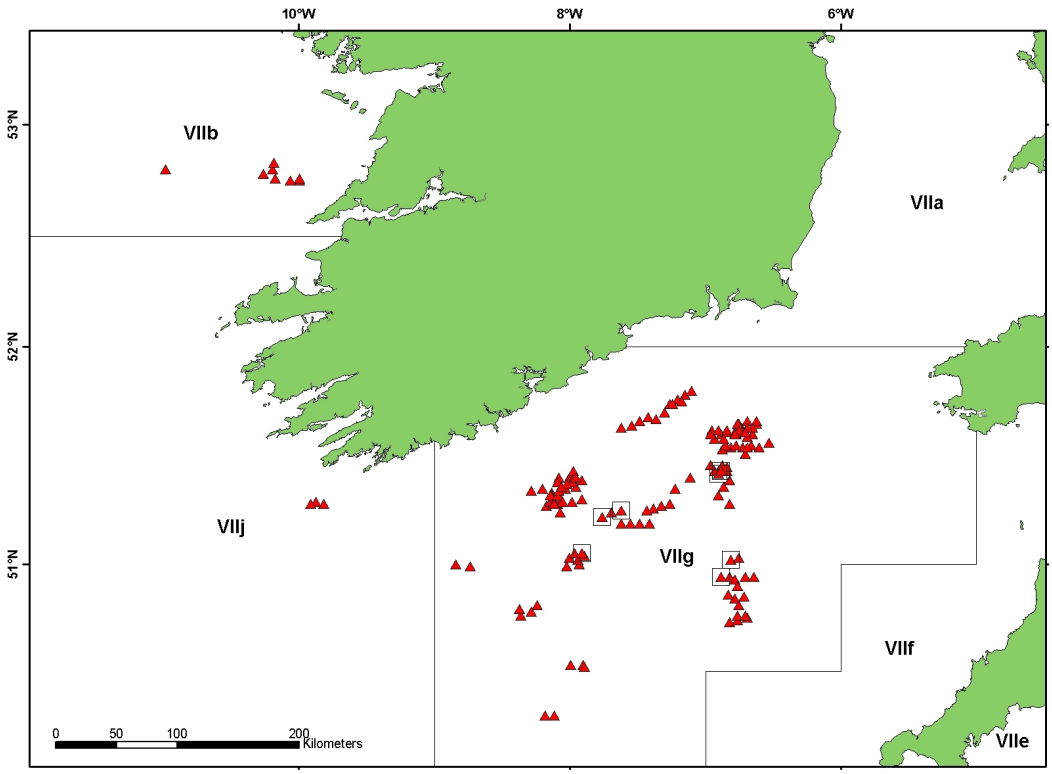

Figure 1. Position of 152 hauls used in pinger spacing analysis. Porpoise by-catch points are represented by clear squares.

Porpoise bycatch

A total of 152 hauls/stations measuring a 637 km carried out over 13 trips from May 2005 to June 2007 were used in the pinger spacing analysis when all data were combined, with a total by-catch of 7 harbour porpoises (Table 1., Figure 1.).

Three porpoises were taken in control nets during Aquamark pinger deployments in the dedicated pinger spacing trials. Another 2 animals were taken as by-catch in nets with Fumundas attached, one in nets with 200m spacing and one in nets at 600m spacing. These stations were recatagorised as control deployments because the Fumunda pinger did not function correctly. Two more animals were taken as by-catch in control deployments in the 2005 pinger practicality trials. No porpoises were caught in nets with Aquamarks mounted at 200m or 600m.

The by-catch rate for stations with Auqamark pingers spaced at 600m was not significantly different from stations with 200m spacing (P=1). However neither were these stations significantly different when compared with the control stations (P = 0.27). Data for all stations carrying pingers were pooled together and tested with the control stations. Although not significant to a level of >95% confidence, a P value of 0.098 was obtained meaning that <10% probability exists that these groups are not statistically different.

The Danish Institute for Fisheries Research (DIFRES) carried out a similar pinger spacing experiment using Aquamark 100 pingers in the Danish North Sea hake gillnet fishery in 2006. The results of the trial were clear and conclusive with a 100% reduction in porpoise by-catch in nets with 455m spacing and 78% reduction in by-catch in nets with 585m spacing with no significant difference between pinger spacing groups (Larsen and Krog, 2007). The report concluded that pinger spacing using Aquamark 100 pingers can be increased to at least 455m without reducing their effectiveness.

Other cetacean species by-catch
Three common dolphins (*Delphinus delphis*) and 1 striped dolphin (*Stenella coeruleoalba*) were also caught during the trials. Two of the commons were caught in nets with active Aquamark 100 pingers at 200 and 600m spacing with the other common caught in a net with Fumunda pingers at 600m spacing. The striped dolphin was caught in a control net during Fumunda deployments. No evidence exists that pingers developed specifically for porpoises have any deterrent effect on common or striped dolphins so by-catch of these species was irrelevant to the pinger spacing analysis conducted in this study. However these by-catch incidences are analysed in the report "Cetacean by-catch rates in Irish gillnet fisheries in the Celtic Sea" (Cosgrove and Browne, 2007)

Comparison of fish catch rates
Fish landings were compared for nets with Aquamark pingers attached and control nets with no pingers attached deployed at the same general time and location during the 2006 spacing trial. Landings of hake were relatively low so catches were expressed as boxes of whitefish. The mean fish catch rates were not different between nets with pingers and nets without ($P=0.48$; 73 d.f.; $\alpha=0.95$).

Pinger Performance
The Aquamark pingers performed well with all 26 units functioning correctly at the end of the trial. Health and safety issues arose regarding the use of Fumunda pingers due to the large scale failure of housings and resulting exposure of batteries to water. Fumunda pingers were used in 2005 durability trials and performed relatively well with approximately 20% of pingers non functional at the end of extensive sea trials primarily due to the battery losing contact inside the pinger and with no major signs of external damage. The batch of Fumundas used in the present study was assembled at a new manufacturing facility which may have upset the quality control process during manufacture.

From a total of 37 Fumundas deployed, the outer casing was seriously damaged in 20, a rusty residue had appeared at the mid connection point on a further 13, no external damaged was displayed on 3 units and 1 was lost. None of the pingers were functional at the end of this trial. Failure of the outer casing caused the lithium-thionyl chloride ($Li-SOCL_2$) batteries to be exposed to sea water. Water seeping into compromised housings is likely to have caused batteries to short circuit and this may have caused pingers to explode which would explain the ruptured state of damaged pingers. The majority of damaged pingers were also accompanied by corrosion of the nylon covers and ropes used to mount the pingers which was caused by an acidic substance seeping from the batteries

which may have been hydrochloric acid. In addition, on several occasions during hauling, gas was observed emanating from pingers which may have been sulphur dioxide (SO_2). One observer experienced some respiratory difficulties after inhaling some gas while inspecting a damaged pinger.

Discussion

Relatively low by-catch rates of harbour porpoises in the Celtic Sea mean that it is unlikely that it will ever be possible to obtain statistically significant results from pinger spacing trials in this area. Trials in the North Sea where by-catch rates are approximately 7 times higher than the Celtic Sea (Cosgrove and Browne, 2007) were far more conclusive and the Danish government have issued a derogation permitting fishermen there to use Aquamark pingers at a spacing of 455m based on the results of the trials. Furthermore these trials found that there was no statistical difference in by-catch rates from nets with pingers spaced at 455 and 585m and a 78% reduction in by-catch was observed in the nets with 585m spacing.

Recent research by BIM has produced a total estimated porpoise by-catch for the Irish gillnet fleet operating in the Celtic Sea of 430 animals in 2006 (Cosgrove and Browne, 2007). A 78% reduction in porpoise by-catch in Irish gillnet fisheries in the Celtic Sea would result in a total estimated by-catch of 95 animals for the entire fleet. This equates to 0.12 % of the Celtic Sea harbour porpoise population abundance estimate which is a small fraction of current thresholds of acceptable by-catch (ASCOBANS, 2000, 2006). Fishermen should therefore be permitted to use pingers at a spacing of approximately 585m on gillnets in the Celtic Sea.

Major health and safety issues arose during these trials regarding the use of lithium batteries in pingers. If it is absolutely necessary to use this type of battery the manufacturers should consider using moulded or sealed pingers so that the likelihood of batteries coming into contact with seawater is greatly reduced.

References

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