

Agenda Item 4.2

Priorities in the Implementation of the
Triennium Work Plan (2010-2012)
ASCOBANS Conservation Plan for Harbour
Porpoises in the North Sea

Document 4-05 rev.1

**Interim Report on Progress to
develop further the ASCOBANS
Conservation Plan for Harbour
Porpoise in the North Sea**

Action Requested

- Take note of the report
- Comment
- Provide guidance to the consultants on the next steps to be taken
- Decide on the composition and mode of operation of a North Sea Working Group

Submitted by

Secretariat



NOTE:
IN THE INTERESTS OF ECONOMY, DELEGATES ARE KINDLY REMINDED TO BRING THEIR
OWN COPIES OF DOCUMENTS TO THE MEETING

Secretariat's Note

1. This document contains an updated interim report submitted by the consultants hired for the coordination of the Conservation Plan for Harbour Porpoises in the North Sea. Annex 1 shows the work plan agreed with the consultants in consultation with Peter Reijnders and Mark Tasker. Annex 2 shows the Terms of Reference for the assignment, which have been prepared in line with the decision of AC16 (see Annex 17 of the AC16 Report).
2. The consultants informed the Secretariat that they have so far used about 8 of the 27 working days agreed. They now seek the guidance of the Advisory Committee on the following points:
 - What next steps they should take, i.e. whether to complete self contained items or start initiatives which are likely to be continued after the end of their contract
 - Whether there are data gaps or specific issues in the report where more information would be considered useful
3. The Advisory Committee is also requested to decide on the composition and mode of operation of a North Sea Plan Working (or Steering) Group, if such a group is desired. The Group would, supported by a Coordinator (dependent on the availability of funding) and the Secretariat, ensure the implementation of Activity 8 in the Triennium Work Plan 2010-2012:

“Promote and coordinate the implementation of the Conservation Plan for Harbour Porpoises in the North Sea, gather information on its implementation and the results obtained, inform the public and evaluate the effectiveness of the Plan every three years to update it”
4. The Committee is reminded that the Conservation Plan for Harbour Porpoises in the North Sea was adopted unchanged at MOP6 and can be accessed at http://www.service-board.de/ascobans_neu/files/MOP6_7-02_NorthSeaConservationPlan.pdf. Resolution No. 1 of MOP6, adopting both the Jastarnia Plan and the North Sea Plan, will be published online as soon as possible as a self-standing document.

INTERIM REPORT ON PROGRESS TO DEVELOP FURTHER THE ASCOBANS CONSERVATION PLAN FOR HARBOUR PORPOISE IN THE NORTH SEA

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Updated report 04/09/2010

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Scope of work

The Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) adopted a new Conservation Plan for the Harbour Porpoise in the North Sea on 18th September 2009 at its sixth meeting of parties in Bonn, Germany.

The Plan identifies bycatch as the main threat. Thus this initial work concentrates entirely on issues related to bycatch. The agreed workplan specified the headings:

1. Document relevant regulations and guidelines and review reports on implementation.
2. Promoting and explaining the plan to stakeholders
3. Practical implementation of the plan (Monitoring and mitigating bycatch from small vessels)
4. Data collection and fishing effort.
5. Data on anthropogenic activities suitable for GIS.

This interim report covers preliminary work on items 1-4. This preliminary work and the further work under the current contract are intended to prepare for the appointment of a full-time co-ordinator for the Plan.

Introduction

The Conservation Plan covers the area based on the definition of the North Sea from the 5th International Conference on the Protection of the North Sea in March 2002. This covers or partially includes ICES fishing areas IIIa, IVa, IVb, IVc, VIId, and VIIe. Since the boundaries of the area do not relate directly to porpoise populations, threats to porpoises within adjacent areas will also affect the conservation status of porpoises within the North Sea. The North Sea includes waters of seven out of the ten ASCOBANS parties (Belgium, Denmark, France, Germany, The Netherlands, Sweden and United Kingdom) and also range state Norway.

In April 2010, the ICES Working Group on Marine Mammal Ecology recommended that the Conservation Plan 'take into account the existence of the two newly designated harbour porpoise Management Units in the North Sea, Northeastern North Sea and Skagerrak and Southwestern North Sea and Eastern Channel, with the inclusion of the Shetland Islands, Skagerrak and northern Kattegat within the Northeastern North Sea Management Unit' (ICES, 2010a).

1. Relevant regulations and guidelines and review reports on implementation.

The most general requirement relating to harbour porpoise bycatch for EU countries comes from the Habitats Directive (92/43/EEC on the conservation of natural habitats and of wild fauna and flora). The harbour porpoise is listed in Annex II and Annex IV. Under Article

12(4) ‘Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV. In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.’

More specific measures are specified in EU 812/2004 concerning incidental catches of cetaceans in fisheries. These measures relate to monitoring requirements and mitigation measures using acoustic deterrent devices ‘pingers’ for specific fisheries. The measures in EU 812/2004 are in addition to the more general provisions within the Habitats Directive. Collection of fisheries data to evaluate the environmental impact that may be caused by fisheries on the marine ecosystem is also required under Council Regulation (EC) No 199/2008 concerning the establishment of a Community framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.

The ICES Study Group for Bycatch of Protected Species (SGBYC) coordinates activities under EU 812/2004, including observer programmes and bycatch mitigation trials. SGBYC meets annually and reviews annual reports from member states that address the obligations of Regulation 812/2004 (ICES, 2009; ICES, 2010). The European Commission had become aware of difficulties in the implementation of Regulation 812/2004 and organised a workshop on in Brussels, 24-25 March 2009 (EC, 2009). In addition, in June 2010, the European Parliament published a study (European Parliament, 2010) on mitigation of incidental catches of cetaceans in EU waters. The study included an assessment of the regulatory framework adopted in the EU, focussing primarily on Regulation 812/2004 and the Habitats Directive. Specific key recommendations from this report are listed under the relevant items below.

1.1 Bycatch mitigation measures under EU 812/2004

The regulation specifies areas and types of fishing gear where the use of pingers is mandatory for vessels over 12m in length. The North Sea fisheries for which this applies are listed in Table 1.

Table 1. North Sea fisheries in which the use of acoustic deterrent devices is mandatory

Area	Gear	Period
ICES sub area IV and division IIIa	Any bottom-set gillnet or entangling net, or combination of these nets, the total length of which does not exceed 400m	1 August - 31 October
ICES sub area IV and division IIIa	Any bottom-set gillnet or entangling net with mesh sizes > 220 mm	All year
ICES divisions VIIId and VIIe	Any bottom-set gillnet or entangling net	All year

The technical specifications and conditions of use of pingers are specified in Annex II of 812/2004. This specifies a minimum distance between devices along the net, the frequency characteristics and source levels. For devices that generate the signal digitally, the specified source level is 145dB re 1 μ Pa@1m with a maximum spacing along the net of 200m, with one acoustic device fixed at each end of the net.

Pinger spacing may also be set by national laws. In Denmark, pinger spacing was increased from 200m to 455m following successful trials with a wider spacing (reported in ICES, 2009). Ireland also issued a derogation in June 2007 allowing an increase in maximum pinger spacing to 500m. The UK has also applied for derogation (under Article 3 of Regulation 812/2004) in order to trial an alternative pinger device with different specifications (Northridge and Kingston, 2010).

1.2 Monitoring requirements under EU 812/2004

The regulation requires Member States to design and implement monitoring schemes for incidental catches of cetaceans using observers on board the vessels flying their flag and with an overall length of 15m or over. The monitoring should provide representative data of the fisheries concerned. For vessels less than 15m Member States are required to take the necessary steps to collect scientific data on incidental catches of cetaceans by means of appropriate scientific studies or pilot projects.

The North Sea fisheries for which monitoring is required under 812/2004 are listed in Table 2.

Table 2. North Sea fisheries to be monitored under EU 812/2004

Area	Gear
ICES sub area IIIa, IV, VII	Pelagic trawls (single and pair)
ICES sub areas VII	High-opening trawls

A primary objective of the monitoring is to estimate total bycatch by species for each fishing fleet. The regulation requires monitoring schemes to be based on a sampling strategy designed to allow estimation of the by-catch rates with a coefficient of variation not exceeding 0.3. However, for fleets where there was insufficient data to design sampling strategies towards achieving a $CV < 0.3$ 812/2004 required Member States to implement pilot on-board observer schemes for two consecutive years. The proportion of the fleet to be monitored is given in Table 3.

Table 3. Minimum monitoring requirements for two year pilot schemes specified in 812/2004

	Fleets of more than 400 vessels	Fleets of more than 60 and less than 400 vessels	Fleets of less than 60 vessels
All fisheries in Table 2.	The fishing effort of 20 vessels	5% of the fishing effort	5%, covering at least 3 different vessels
For pelagic trawls (single and pair) from 1 December to 31 March in ICES sub area VII		10% of the fishing effort	10%, covering at least 3 different vessels

1.3 Monitoring harbour porpoise bycatch in Norway.

Bjørge and Godøy (2009) report on monitoring of harbour porpoise bycatch in Norway. Following a pilot study in 2004, bottom set gill net fisheries were identified as priorities for bycatch monitoring. In 2006, 2007 and 2008 the gill net fisheries for cod (*Gadus morhua*) with a stretched mesh of 16-24cm, and anglerfish (*Lophius piscatorius*) with a stretched mesh of 36cm, were monitored. A sub-sample of the fleet (18 vessels of less than 15m total length) was observed throughout all three years. These vessels involved in the monitoring were

contracted by the Norwegian Institute of Marine Research to report detailed statistics on effort, catch and bycatch. Contracts for this work were given to two vessels in each of nine domestic fishery statistics areas.

1.4 Effectiveness and implementation of EU 812/2004

The SGBYC had identified problems with reporting at its meeting in 2008 (ICES, 2008). ICES (2009) noted that the lack of a consistent reporting format meant that it was impossible for the SGBYC to reconcile pilot projects and scientific studies with the obligations under 812/2004. The SGBYC repeated its previous recommendation that national reports on data collected under Regulation 812/2004 are submitted to the Commission in a standard format as proposed by ICES. These recommendations were repeated in 2010 (ICES, 2010). However, the EU's Scientific, Technical and Economic Committee for Fisheries (STECF) had circulated a draft reporting format to Member States for comment in September 2009 and it is anticipated that this will be in place for future reports. Despite these problems, the SGBYC concluded in 2010 that Regulation 812/2004 had succeeded in providing a 'much more comprehensive picture of cetacean bycatch in European fisheries'.

The overall conclusion by European Parliament (2010) with regard to monitoring was that 'there has not been sufficient sampling in the right fisheries or areas to enable sound management decisions to be made with respect to cetacean bycatch'. More specifically the study noted that;

- Article 12 of the Habitats Directive (requiring monitoring of bycatch) had not been implemented by any member state prior to 2004 and that Regulation 812/2004 provided a means to enforce Article 12 and to generate reports on monitoring activities. In addition, the obligation to monitor incidental catch under the Habitats Directive had been widely ignored in favour of establishing protected areas that are unlikely to be able to address conservation goals.
- The monitoring target of a precise bycatch estimate with a CV of 0.3 has not been very effective in managing cetacean bycatch in Europe, and this target could well be rethought.
- The observations made so far under Regulation 812 are a patchwork of relevant and irrelevant monitoring. Greater flexibility and co-ordination is required in allocating monitoring effort.
- A more general approach whereby Member States would be required to demonstrate their fisheries were not exceeding some agreed level of cetacean bycatch would be a more appropriate way of ensuring sufficient sampling to address the management questions without overburdening Member States with excessive monitoring requirements.

The need for a flexible approach has been emphasised for both monitoring and mitigation measures (European Parliament, 2010, ICES 2010c). This is particularly important in view of the changes in porpoise distribution patterns in recent years. The SCANS surveys indicated a southward shift in distribution between 1994 and 2005, but measured no change in overall abundance. Results from a Norwegian survey in the northern North Sea (Øien, 2010) suggest further declines in this area relative to the SCANSII data in 2005. The authors note that 'Compared to the previous NILS survey conducted in the North Sea in 2004 the most striking feature is the nearly complete absence of harbour porpoise observations in 2009'. Based just on numbers of sightings and effort (Bjorge and Øien, 1995; Øien, 1996; Øien, 2005), the sightings rate for 2009 in the northern North Sea was less than 10% of the average from

surveys in 1989, 1995 and 2004 which showed relatively little variation (mean n/L = 0.05 groups per nm, SD=0.008).

1.4.1 USE OF PINGERS

Aside from reducing fishing effort, European Parliament (2010) suggests that pingers are the only technical measure that is known to work in reducing cetacean bycatch in EU fisheries. In addition, the authors suggest that the collateral effects of pingers, particularly habituation and habitat exclusion are unproven and that it seems reasonable to assume that the proven efficacy of pingers at reducing harbour porpoise bycatch currently outweighs any potential negative collateral effects

The fishing industry has raised serious concerns over the reliability and effectiveness of the currently available pingers and also safety issues related to deployment (including chemical leakage from batteries, entanglement in gear, or the need for additional crew to attach devices during shooting). This has resulted in overall low levels of compliance with the pinger requirements in 812/2004. Although there are no official records of the number of vessels using pingers, European Parliament (2010) indicates around eight vessels in Denmark and five in the UK (although not necessarily in the North Sea).

Under Regulation 812/2004 the fisheries where pinger use is mandatory and the fisheries for which monitoring is required are different. A result of this is that there is very little information available on the compliance with the use of pingers. The gears specified for mandatory pinger use in ICES subarea IV and division IIIa also do not include many of the gear types known to catch porpoises in these areas. Nets of mesh size of smaller than 220mm may still be used without pingers if they are longer than 400m or between the period of 1st November to the 31st July. Haelters and Camphuysen (2009) review bycatch data for the southern North Sea waters of Belgium and the Netherlands. Gillnets used by Belgian and Dutch fishermen for bass or cod are monofilament with a mesh size of 120-160mm. In the waters of these two countries a substantial harbour porpoise bycatch is occurring in fisheries which are not covered by 812/2004. SMRU (2009) also notes difficulties in determining whether pinger requirements were being met by the UK fleet in ICES sub area IV. Although some vessels appeared to be wreck fishing (which was intended to be covered by fisheries in line 1 of Table 1) there was no way to determine whether the total length of net was less than 400m. Individual net lengths and lengths of combinations of nets are not recorded in the UK Fleet Activity Database so it was not possible to determine which boats should be using pingers in the sub-area IV. In Germany, pinger detectors (type PD1109) were fitted to fisheries protection vessels in 2008. However, it was noted that it is difficult to demonstrate an infringement with the Regulation on pinger usage because the only requirement is that acoustic deterrent devices must be fully operational when setting the gear (ICES, 2010b).

There have also been new research results on the effectiveness of pingers in relation to pinger spacing and functionality. Successful trials at wider spacings prompted changes to national laws in Denmark and Ireland. In the US results from a large data set in the Gulf of Maine found harbour porpoise bycatch rates in hauls with some pingers, but less than the required number, were much higher than bycatch rates of hauls without pingers (Palka *et al.*, 2008). Although the specification in 812/2004 refers to a narrow range of source levels for pingers, actual received levels can vary considerably (e.g. 6-10dB at ranges of 100m) due to interference effects from reflections from the sea surface and sea bed (Shapiro *et al.*, 2009). Louder pingers that could be deployed at wider spacings (e.g. DDD-02 devices from STM

products in Italy) have also been tested on gill-nets in the UK to investigate effectiveness at bycatch reduction and also potential for habitat exclusion (ICES, 2009). Further trials including a new model (DDD-03) have continued to show that the DDDs being tested appear to work well in terms of reducing porpoise bycatch and operational problems are being addressed (Northridge and Kingston, 2010).

All these studies need to be considered when considering the best type of pinger for a particular fishery and it is suggested within the Plan that a more flexible approach than 812/2004 would be beneficial. Developments such as the *Bycatch Reduction Techniques Database* at (www.bycatch.org) hosted by New England Aquarium (Boston, USA) provide a searchable database of results from studies undertaken to evaluate bycatch mitigation.

1.4.2 ESTIMATING BYCATCH

Although monitoring programmes have been undertaken towards the objectives in 812/2004 the data collated so far from published reports and/or communicated to the SGBYC did not provide nor allow the estimation of any total bycatch numbers (ICES, 2009). The estimates that are available from other studies are listed in Table 4 of the Plan.

The monitoring schemes developed under 812/2004 have reported no porpoise bycatch in the North Sea (Table 5 of ICES, 2009). A consequence of this is that it has not been possible to determine sampling levels that will be required to obtain a bycatch estimate with a target CV of 0.3 as required by 812/2004 (ICES, 2009). The two year periods for the pilot schemes specified in 812/2004 are now over but monitoring at the specified levels (5% and 10%) in the absence of being able to design schemes to achieve a $CV < 0.3$ continued in 2008 and 2009 for the relevant UK fisheries (SMRU, 2009). Other approaches to setting targets for sampling levels have been suggested (e.g. Northridge and Thomas, 2003). Where bycatch limits for a population have been established on the basis of an agreed procedure and set of input data (see Winship, 2009) the level of effort for bycatch monitoring schemes could be designed to ascertain whether the take was below these limits with a given level of confidence or alternatively to flag concern if there was a specified probability that bycatch could be greater than the limit. The SGBYC have suggested these as potentially more appropriate approaches than currently specified in 812/2004 (ICES, 2009).

Although the monitoring schemes instigated to meet the requirements under 812/2004 reported zero bycatch of harbour porpoise in the North Sea, this was not the case for all monitoring schemes and is not an indication that porpoise bycatch is not occurring. For UK fisheries, two bycaught porpoises were observed in gill-nets targeting bass in the southern North Sea during 2008 (SMRU, 2009). Haelters and Camphuysen (2009) also report substantial bycatch observed along the coasts of Belgium and the Netherlands. Between 2005 and 2008, 24 harbour porpoises were also observed as bycatch in UK fisheries for the whole of ICES sub area VII (including the western Channel covered by the Plan), resulting in a total extrapolated estimate of 838 for 2008 (SMRU, 2009). Northridge and Kingston (2010) used average catch rates from observations since 2005 to estimate a porpoise bycatch for this area of 616 ($CV=0.16$) in 2009.

1.5 Results from monitoring in Norway

The Norwegian study appears to have been successful in monitoring bycatch in commercial vessels of less than 15m length and it is planned to extrapolate the sample to the full fleet. The strategy has been to intensively sample fisheries sectors until enough data have been obtained to obtain estimates and then the plan is to shift (or expand the programme) to other sectors

(Bjørge and Godøy, 2009). In Norway, all commercial landings are sold through an auction system, giving good landing statistics for the target species. However, non-target species may not be sold resulting in a poor understanding of levels of take of these species. Landings from recreational fishermen are also poorly known. The monitoring system was designed to improve statistics for fishing effort and takes of all non-target species. Contracted fishermen are paid for providing detailed data on effort and catch of all species including marine mammals and birds. Staff from IMR visit the contracted vessels and follow them at sea for day trips. Any discrepancies between reported statistics from days with a scientist and days without a scientist may result in termination of the contract. Contracts have been cancelled on two occasions and this measure appears to be provide sufficient motivation for accurate reporting by the other fishermen (A. Bjørge pers. comm.).

Table 4. Observed harbour porpoise bycatch from a monitoring study of Norwegian gill net fisheries for cod and anglerfish (Bjørge and Godøy, 2009).

ICES Area	2006	2007	2008
IIIa	10	1	7
Iva	4	19	17
IVb	10	78	43

2. Promoting and explaining the plan to stakeholders

Inevitably there will be differences in the way that the plan should be promoted and explained to stakeholders in each country. However, there are some general principles to consider in identifying the key groups of stakeholders and then working with them. In each country, the stakeholders include statutory government agencies, commercial fishermen and their industry bodies, recreational fishermen, environment and animal welfare non-governmental organisations (NGOs). In addition, there will be some key regional organisations and bodies. For example, the North Sea Regional Advisory Council (NSRAC) was established in November 2004 to provide greater stakeholder involvement in fisheries management at a regional level. Members of the General Assembly of the NSRAC are listed at <http://www.nsrac.org/category/members/general-assembly/> and include fish producer's organisations, environmental NGOs, and trade NGOs in addition to fishermen's organisations.

Two recent examples of consultation exercises are the consultation regarding the review of the EU Common Fisheries Policy and the development of the UK Marine and Coastal Access Bill which has recently been adopted and is now in the process of being implemented. Whilst consultation processes are different to the task of promoting and explaining the Plan to stakeholders, the task of identifying and involving the stakeholders is similar.

2.1 EU CFP Review as an example

The consultation regarding the review of the EU Common Fisheries Policy commenced with publicity regarding the process and timescale of the review. Comments were sought by the deadline of 31 December 2009 and are now listed on the EU web site¹. Comments are divided into Registered Organisations (61 comments), Public Authorities – European, National, Subnational (72 comments), individual contributions (104 comments) and unregistered organisations (107 comments). However, categorisation of the organisations appears difficult and some organisations are not in the most appropriate categories. The scale of the consultation is shown both by the total number of comments received (344) and the detail of some of the comments which show that considerable work has been put in. Whilst

¹ The comments on the CFP review are available on http://ec.europa.eu/fisheries/reform/consultation/received/index_en.htm

we cannot be sure, it appears that the process of CFP review was largely passive with stakeholders simply invited to contribute to the consultation through the well-advertised process. The shortcoming of this approach is a possible failure to engage critical stakeholders who may not be aware of the review process simply because they are not following events at the EU level.

2.2 UK Marine Bill Consultation as a case study.

The process of consultation during the adoption and the implementation of the UK Marine and Coastal Access Bill involved both passive and active elements. Whilst the timetable and process was advertised and made available through UK Government media and web sites, an active effort was also undertaken in order to engage key stakeholders. Some 6000 stakeholders were listed by the Department for the Environment, Food and Rural Affairs (DEFRA) which is the UK Government Agency responsible for the Marine Bill. From this large list, key stakeholders were identified and invited to a series of one-day meetings, held in different regions of the country. At those meetings, efforts were made by DEFRA staff to explain the process of consultation, the timetables for comment and encourage a collaborative atmosphere amongst those present. One of us (VP) attended some of those meetings. An active section of the DEFRA website, together with regular emails serves to keep stakeholders up-to-date with current developments. As in all consultations, it remains to be seen how the process will take account of stakeholder's views (Beder 1999). However, the process does result in the active engagement of key stakeholders and their empowerment through understanding the process and timescale. In addition, such a process of hosting meetings encourages friendly collaboration, particularly during the informal parts of the meetings.

2.3 Proposal for Promoting and Explaining the Plan to Key Stakeholders.

It is proposed that an active approach to seek out the key stakeholders in each country should be combined with the passive approach of publicising the Plan and its key components to invite engagement by stakeholders. An active approach will encourage cooperation which will be a key element in ensuring the success of the Plan. In particular, for specific initiatives it is critical to identify the stakeholders whose activities directly impact harbour porpoise conservation and who need to be involved. These participants need to be provided with adequate information and engaged in an ongoing dialogue.

3. Monitoring and mitigating bycatch from small vessels (<15m)

The need to include smaller vessels in mitigation and observations schemes has been recognised by European Commission (2009). ICES (2010b) also note that a sampling strategy for vessels < 15 m needs to be established taking account the specific problems with monitoring such vessels.

3.1 Electronic monitoring systems

There have been several trials of electronic monitoring systems involving video cameras directed at the catch coming into the vessel in order to monitor catch, bycatch and discards. Archipelago has successfully developed and deployed video based electronic monitoring (EM) on a variety of fisheries, gear, and vessel types (McElderry *et al.*, 2006, McElderry, 2008). Typical systems involve several closed circuit television cameras, a GPS receiver, and a number of sensors. Sensors such as hydraulic pressure sensors, and gear rotation sensors control the periods for which the cameras record.

Dalskov and Kindt-Larsen (2009) describe results of a study in Denmark during 2008/09 using the Archipelago video-based system in order to provide a complete documentation of all

catches including discards. The study included one netter of length <15m. The six other vessels were between 16 and 31m. Up to four video cameras were used to view the aft deck, the fish handling areas and discard chutes. Image quality of the video recordings was sufficient to allow reliable estimates of species and size composition of the catch. The authors note that the system proved reliable and significant cheaper than obtaining the same documentation using onboard observers. Video sequences were viewed ashore with on average less than one hour data of analysis and image viewing required for verifying one fishing event and the associated catch handling.

The Danish national report under 812/2004 summarised in ICES (2010b) notes that videos from one participating gillnet vessel were analysed in relation to marine mammal bycatch. Data from September-December 2008 resulted in bycatch of one porpoise (*Phocoena phocoena*) and one seal (*Phoca vitulina*) with a video monitoring coverage of 100%. The report concluded that the system can be used to monitor bycatch of marine mammals and that a more widespread use of CCTV could function as a substitute to the observer schemes as these schemes are a much cheaper way of monitoring the fishery.

The New Zealand Ministry of Fisheries has also evaluated the feasibility of using electronic monitoring (EM) for assessing protected species interactions in demersal longline fisheries (McElderry *et al.*, 2008). Monitoring long-lines may present similar challenges to harbour porpoise bycatch in gillnets where bycatch animals may fall out of the gear before being hauled on board the vessel (Tregenza *et al.*, 1997). The trial also used the Archipelago system alongside fisheries observers. The level of agreement between observers and EM varied considerably depending on camera positions and the protected species involved (McElderry *et al.*, 2008).

EM using video systems clearly has the potential to provide the type of data needed to estimate harbour porpoise bycatch. Camera configurations designed to determine the catch brought aboard the vessel should have no problem in detecting porpoises that are also brought on board. This would generate minimum estimates of bycatch, but additional camera monitoring the gear in the water maybe necessary to observe animals that are not brought aboard. For all such systems there are trade offs between complexity, reliability, quality of data and cost. The pace of change in imaging technology, communications and data storage require that developers anticipate changes for any systems are developed over a period of several years. There is also a need to obtain the full co-operation of the fishermen involved.

It is possible that systems for detecting harbour porpoise bycatch could be more simple than those developed to examine the full content of the catch. Porpoises are large and conspicuous and may take some handling time, requiring less image resolution and lower frame rates. This smaller data requirement may allow cameras to operate continuously, removing the need for external sensors to be fitted to the vessel. The camera sequences selected for viewing could be based on analysis of GPS data suggesting fishing activity (see section 4.2). If power requirements could also be reduced such that the system could be entirely self-sufficient it would be more realistic to fit to smaller vessels and quicker to install.

The current costs of EM equipment are relatively high and there are additional costs associated with viewing video and data analysis. Nevertheless, EM can provide data at lower cost than observers (Dalskov and Kindt-Larsen, 2009). Reducing equipment costs such that more units could be deployed across the fleet would initially increase analysis costs. However, the presence of EM equipment may also provide an incentive to report bycatch.

Sub-samples of EM data could then be checked against reports, removing the need for a full analysis of all EM video. European Parliament (2010) notes that remote monitoring using CCTV is well suited to monitoring rare events such as cetacean bycatch and should be considered in the future.

4. Monitoring fishing effort

4.1 MANDATORY SYSTEMS FOR VESSELS >15M

There have been several technological developments in recent years that will facilitate the collection of data on fishing effort using Vessel Monitoring Systems (VMS) and Automatic Identification System (AIS). There have also been new requirements for electronic recording and reporting of fishing activities for vessels over 15m established under Council Regulation (EC) 1966/2006. The required data are specified in (EC) 1077/2008. Specification of gear type is particularly relevant to bycatch and this is done according to FAO's 'International Standard Statistical Classification of the Fishing Gear'. The SGBYC has also recommended that any revision of Regulation 812/2004 should include an agreed international description of fishing gear categories suitable for bycatch monitoring (ICES, 2009).

VMS was introduced under EU regulations (EC) 686/97, 1489/97 and most recently 2244/2003. Since 2005, VMS has been required for all vessels over 15m length. VMS is a satellite based system which relays locations to a centralised national data centre every few hours. AIS is a VHF system (working on 161.975 MHz and 162.025 MHz) which transmits the vessel's location, course and speed continuously. It was developed to improve the safety and reduce collision risks for large merchant vessels and transmissions between vessels or to shore stations are generally limited to line of sight. Within the EU, fishing vessels with an overall length of more than 15m will be required to use AIS. Directive 2009/17/EC of the European Parliament sets the timeline for AIS requirements for different sizes of fishing vessels with larger vessels being required to use AIS in 2012 and all over 15m vessels in 2014 (Table 5). The Directive recognises the potential financial burden and notes that financial assistance may be provided for fitting AIS equipment on board of fishing vessels through the European Fisheries Fund.

Witt and Godley (2007) used VMS data from UK vessels to examine patterns of fishing effort and concluded that VMS data generated a spatially and temporal explicit view of fisheries activity at a far greater resolution than catch-book statistics. They applied filters to speed data in order to detect broad activity categories based on data transmitted on a 2-hour duty cycle. Mills *et al.*, (2007) applied a similar approach specifically to identify beam trawling effort in the North Sea from VMS data on speed and heading changes. AIS data will be available on a much finer temporal scale and so it would be expected that signature movement patterns from different activities would be easier to distinguish. There appears considerable scope for collaborative research with fishermen to develop reliable algorithms that could determine activity from GPS data. For larger vessels VMS data offer the opportunity to collect effort data throughout EU waters at a rather coarse scale whereas AIS data will allow very fine scale analyses for areas where a network of coverage can be achieved.

Table 5. Dates for which use of AIS equipment will be mandatory on fishing vessels flying the flag of an EU Member State and registered in the Community, or operating in the internal waters or territorial sea of a Member State, or landing its catch in the port of a Member State (Directive 2009/17/EC).

Length of vessel	Date AIS required
24-45m	31 May 2012

18-24m	31 May 2013
15-18m	31 May 2014
Newly built vessels > 15m	30 November 2010

4.2 MONITORING VESSELS <15M

Monitoring fishing effort for fishing vessels less than 15m in length is a widely acknowledged problem. These smaller vessels include a wide range of activity levels including full-time commercial, part-time commercial and recreational fisheries. There remains considerable uncertainty over levels of harbour porpoise bycatch and effort for smaller vessels. While there are some reporting requirements for commercial vessels over 10m (Council Regulation 2847/93) these are limited to declarations of landings.

Haelters and Camphuysen (2009) note that in Belgium and the Netherlands data on the extent, gear types used and catches in recreational or semi-professional fisheries are scarce and fragmentary. This assessment is also likely to apply to the other North Sea states.

VMS and AIS are rarely fitted to vessels <15m and involve substantial costs. However, simple GPS data logging devices are very cheap and require little power because no transmission is involved. Improving technology and battery life allows completely self contained devices to operate for long periods.

Dedicated experiments with GPS data loggers on a small number of vessels where activity was carefully recorded combined with analysis of a much larger AIS data set could evaluate the accuracy of determining effort and activity for small vessels based on simple data logging systems. Where bycatch monitoring schemes are also established for small vessels there is scope to collect detailed effort data for comparison with GPS data.

Prerequisites for any such studies would include compilation of a list of vessels to allow a representative sampling scheme to be devised and approaches to the fishermen to facilitate cooperation. If a workshop were held (see item 3) the practicalities of implementing such schemes in different areas and different fisheries would need to be discussed.

References

- Beder, S. 1999. Public participation or public relations? In: Technology and public participation. Martin, B (ed). Science and technology Studies. Published by University of Wollongong. 249 pages.
- Bjørge, A. and Godøy, H. 2009. Report on Bycatch of Cetaceans in Norwegian Fisheries, 2006-2008. Paper SC/61/SM3 presented to IWC Scientific Committee, Madeira, June 2009.
- Bjørge, A. and Øien, N. Distribution and abundance of harbour porpoise, *Phocoena phocoena*, in Norwegian waters. 1995. *Rep. int. Whal. Commn* (special issue) 16:89-98.
- Dalskov, J. & Kindt-Larsen, L. (2009) Final Report of Fully Documented Fishery. DTU Aqua report no. 204-2009. Charlottenlund. National Institute of Aquatic Resources, Technical University of Denmark, 49 p.
- European Commission. 2009. Cetacean incidental catches in Fisheries: Report on the implementation of certain provisions of Council Regulation (EC) No 812/2004 and on a scientific assessment of the effects of using in particular gillnets, trammel nets and entangling nets on cetaceans in the Baltic Sea as requested through Council Regulation (EC) No 2187/2005. COM(2009) 368 final.

- European Parliament. 2010. Directorate General For Internal Policies Policy Department B: Structural and Cohesion Policies. Fisheries. Mitigation of Incidental Catches of Cetaceans in EU Waters. IP/B/PECH/IC/2009_39. <http://www.europarl.europa.eu/studies>
- Haelters, J. and Camphuysen, K. The harbour porpoise in the southern North Sea: abundance, threats, research and management proposals. http://www.ifaw.org/Publications/Program_Publications/Whales/asset_upload_file741_55396.pdf
- ICES. 2009. Report of the Study Group for Bycatch of Protected Species (SGBYC), 19–22 January 2009, Copenhagen, Denmark. ICES CM 2009/ACOM:22. 117 pp.
- ICES. 2010a. Report of the Working Group on Marine Mammal Ecology (WGMME), 12–15 April 2010, Horta, The Azores. ICES CM 2010/ACOM:24. 212 pp.
- ICES. 2010b. Report of the Study Group on Bycatch of Protected Species (SGBYC), 1–4 February 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:25. 123 pp.
- ICES. 2010c. EC request on cetacean bycatch Regulation 812/2004, Item 1. Special Request Advice May 2010
- McElderry, H. 2008. At Sea Observing Using Video Based Electronic Monitoring. Report prepared for the Electronic Monitoring Workshop held by The North Pacific Fishery Management Council, The National Marine Fisheries Service and The North Pacific Research Board, July 2008.
- McElderry, H, R. Reidy, D. Pahti, 2006. A Pilot Study to Evaluate the Use of Electronic Monitoring on a Bering Sea Groundfish Factory Trawler. Unpublished report prepared for the International Pacific Halibut Commission by Archipelago Marine Research Ltd., Victoria BC, Canada.
- McElderry, H.; Schrader, J.; Anderson, S. 2008. Electronic monitoring to assess protected species interactions in New Zealand longline fisheries: a pilot study. *New Zealand Aquatic Environment and Biodiversity Report No. 24*. 39 p.
- Mills CM, Townsend SE, Jennings S, Eastwood PD, Houghton CA. 2007. Estimating high resolution trawl fishing effort from satellite-derived vessel monitoring system data. *ICES Journal of Marine Science* 64: 248–255.
- Northridge, S. and L. Thomas 2003. Monitoring levels required in European Fisheries to assess cetacean bycatch, with particular reference to UK fisheries. August 2003. Final Report to DEFRA (EWD)
- Northridge, S. and Kingston, A. 2010. Report to the European Commission on the implementation of regulation 812/2004 by the United Kingdom for the calendar year 2009.
- Øien, N. 1996. Cruise and data report from the Norwegian sighting survey 1995 (NILS-95). Paper SC/48/NA3 presented to IWC Scientific Committee, June 1996, Aberdeen (unpublished).9pp
- Øien, N. 2005. Report of the Norwegian 2004 survey for minke whales in the North Sea and southern Norwegian Sea. Paper SC/57/O10 presented to the IWC Scientific Committee, June 2005, Ulsan, Korea. 4pp.
- Palka, D., Rossman, M., Vanatten, A. and Orphanides, C. 2008. Effect of pingers on harbor porpoise and seal bycatch in the US northeast gillnet fishery. Paper SC/60/SM2 presented to IWC Scientific Committee, Santiago, Chile. 27pp.

Tregenza, N.J.C., Berrow, S.D., Hammond, P.S, and Leaper, R. 1997. Harbour porpoise bycatch in set gill nets in the Celtic Sea. *ICES J. Mar. Sci.* **54**(5): 896-904

Winship, A.J. 2009. Estimating the impact of bycatch and calculating bycatch limits to achieve conservation objectives as applied to harbour porpoise in the North Sea. PhD Thesis, University of St Andrews, UK. 243pp.

Witt MJ, Godley BJ (2007) A Step Towards Seascape Scale Conservation: Using Vessel Monitoring Systems (VMS) to Map Fishing Activity. *PLoS ONE* 2(10): e1111. doi:10.1371/journal.pone.0001111