Agenda Item 4.2	Review of New Information on Threats to Small Cetaceans Underwater Noise
Document Inf.4.2.c	**Increasing the Effort to Reduce Marine Noise: a focus on pile driving for offshore wind farms**
Action Requested	• Take note
Submitted by	Whale and Dolphin Conservation, WDC

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Increasing the Effort to Reduce Marine Noise: a focus on pile driving for offshore wind farms

A briefing from WDC based on Workshop 37 held at the International Marine Conservation Congress (IMCC), Glasgow – held on Wednesday 13th August 2014

The notes and interpretation are the responsibility of WDC and not necessarily the views of individual participants.

Introduction

With the introduction of a noise descriptor under the EU Marine Strategy Framework Directive and a US Ocean Noise Strategy, focus has shifted from getting marine noise pollution on the agenda to undertaking research and policy to monitor and manage it, at a national and an international level.

In an attempt to summarise our current biological understanding of the vulnerability of marine mammals to marine noise pollution, and efforts to date to understand and reduce marine noise pollution a workshop was held at the International Marine Conservation Congress in Glasgow during 2014, focussing on the impact of offshore renewables, to bring together practitioners and regulators and with the aim of producing recommendations that can be taken forward.

The workshop also attempted to answer the general questions posed for the conference and specifically:

How can the cumulative effects of the use of new technologies (such as energy infrastructure) be rapidly and effectively assessed, and translated into precautionary policy recommendations?

What are the relative conservation implications of acute versus chronic anthropogenic stressors?

What are the best ways to estimate, evaluate, and manage cumulative impacts and multiple anthropogenic stressors in the marine environment?

Current understanding

Currently only limited research has been undertaken on the impacts of offshore renewables on cetaceans. Most work has been undertaken in Europe, where most development has occurred to date Work has focused on the impacts on harbour porpoises during the construction phase. Studies have been small in number and mainly short term. In the main these studies have shown a reduction in the abundance of harbour porpoises.

Studies have shown:

Noise generated by the construction of offshore wind farms has been found to be audible by harbour porpoises beyond 80 km from the source, it could mask communication at 30 – 40 km and behavioural reactions were observed at 10 – 20 km. (Thomsen et al., 2006)

The installation of monopile foundations has been found to have a profound negative effect on harbour porpoise acoustic activity up to 72 hours after pile driving activity. Research at Horns Rev II wind farm porpoise activity and possibly abundance were reduced over the entire five month construction period. (Brandt et al. 2011)

Research at Nysted offshore wind farm found substantial changes in habitat use, with harbour porpoises leaving the construction area. Only after two years of operation, did the population partially recover - indicating that harbour porpoises were displaced during the construction phase and have not used the habitat to the same extent they previously did. (Carstensen et al., 2006)

The impacts on harbour porpoises from pile diving are recorded many kilometres from the source. Harbour porpoises are being driven out of the area during construction. Numbers are not returning to previous levels years after construction. (Degraer et al., 2013)

Bottlenose dolphins could exhibit behavioural responses at distances of up to 40 km from pile driving locations. (Bailey et al., 2011)

Mitigation

Although several types of mitigation to reduce noise have been proposed they have not been universally applied or monitored. In Germany, where strict noise limits are applied, then mitigation is necessary to enable developments to proceed.

Studies of mitigation using a 'Big Bubble Curtain' (BBC) were undertaken during the construction of one windfarm (Diederichs 2014 – this workshop). The study looked at the technical issues involved, the noise reduction and the responses of harbour porpoises during the construction of 40 tripods with pile driving from September 2011 to March 2012. Piling took place for a duration of 6 hours / tripod (± 3:13) with a blow count of 5,010 strokes /tripod (± 1,058) and an interval of 4-5 days. The study found that BBC could reduce noise levels (SEL) by 12 dB re 1µPa on average (as a result, the German noise limit could be met). The disturbance of porpoises ranged to a SEL-level of ~144 dB SEL which corresponds to a distance of ~15 km without BBC and of ~5 km with BBC. Thus BBC could reduce the disturbance by 90%. Disturbance was found to follow a clear spatial gradient, where more noise equates to a larger area affected, and as a result, more animals are displaced.

However, not all current projects meet these noise criteria, despite the requirement for noise mitigation. There are various problems such as large construction vessels require > 1 km nozzle hose, so in water depths >40m and with large pile diameters costs can be very high.

As noise reduction mitigation is often expensive and logistically difficult to achieve, therefore quantifying the potential to reduce impacts to marine mammals, both at an individual and population level, will be important to fully understand the positive benefit of such techniques.

To demonstrate and quantify the reduction in impact that could potentially be achieved, Verfuss *et al* (2014 – this workshop) used the interim Population Consequences of Disturbance (PCoD) model. The Interim PCoD model uses the same stochastic population dynamic modelling approach as population viability analysis (PVA) coupled with expert opinion on the effects of disturbance on an animal's vital rates where empirical data are lacking. It provides a rigorous, auditable and quantitative methodology, supported by the best available evidence, to assess the consequences of construction noise on a range of marine mammal populations. This model was used to explore the population consequences of a "real world" wind farm construction scenario in German waters, allowing a comparison of cumulative impacts at the population level with and without noise reduction techniques.
In the German North Sea EEZ, about 30 wind farm projects are currently consented allowing for the combined installation of over 2000 turbines. While the first wind farm was built in 2011, the final licensed construction start is due at the end of 2020. A scenario based on this construction programme was modelled using the Interim PCoD model. Initially, the cumulative effect on the harbour porpoise population over 25 years of construction without noise mitigation was modelled. How noise

reduction would affect the impact on the population was then investigated. The results show that the use of noise reduction systems during piling will clearly minimise the cumulative impact of multiple wind farm constructions on the harbour porpoise population. Furthermore, the Interim PCOD framework proved to be a useful means of exploring the potential population level impact of various construction scenarios.

Other ways to reduce noise is to use alternatives to pile driving for foundations. These include drilling and gravity base foundation.

Drilling is a well developed technology that is now being adapted to possible use for wind turbine foundations offshore. It has several advantages over piling in that it can be used in a wider variety of substrate, drill cuttings are re-used to fill the monopole leaving no piles of cuttings on the seabed and noise can be significantly lower than that produced by piling.

As part of the feasibility study on the adaptation of drilling foundations to offshore requirements, in cooperation with the Institute of Technical and Applied Physics (ITAP) from Oldenburg, Germany various measurements were carried out on a foundation working on land (Herrenknecht 2014 – this workshop). For this the sound level in a flooded construction pit during the excavation process was measured and the expected underwater noise emissions at a distance of 750 m predicted. The prediction shows that during operation of a drilling machine, a continuous sound pressure level of 117 dB re µPa can be expected at a distance of 750 m. The peak sound pressure levels are a maximum of 3 dB to 4 dB above this. In contrast to pile driving, with the offshore drilling machine the current BSH reference value is undercut by more than about 40 dB, so that a reduction of the limit is also possible. The method thus represents an eco-logically sound alternative and also offers significant cost savings due to the absence of noise protection measures.

Monitoring and assessment

There are a wide variety of approaches to environmental assessment and monitoring being used to assess the impacts of offshore renewable developments. For example, a variety of instrumentation is available to measure noise pre, during and post construction. Kongsberg have developed a number of recorders including the Over-The-Side (OTS) system; Remote Underwater Noise Evaluation System (RUNES) and Acoustic Monitoring Buoy System (AMBS). Each system has its strengths and weaknesses. It is important to set them up in the right manner taking note of local environmental conditions to ensure that the deployment is ultimately successful (Ward 2014 – this workshop).

The approach to environmental assessment varies greatly between countries, even across EU states which are governed by the same overall directive. For example, in the US the regulator carries out and pays for the environmental assessment (ES). In the UK the developer does.

Monitoring is important to inform our knowledge of actual effects and to feed back into future assessments. However, there was concern that there was too much ‘tick box’ monitoring which, while costly, will not give useful data. For example, it was considered that there is little gain in monitoring porpoise at low densities as change could never be ascertained. Monitoring should be ‘intelligent’ and based on actual perceived impacts. It follows on that this should be thought about pre-application and that baseline surveys (see above) should be similarly targeted to inform post construction monitoring. As with ES, the approach of regulation differs. In the UK monitoring is imposed as a license condition to be carried out by the regulators. In Belgium monitoring is carried out by universities and contractors and is led by an independent committee but paid by developers. This approach, where monitoring

could be targeted to specific impacts and where cumulative issues were also addressed, was favoured.

The variety of assessment and monitoring methods means that assessing overall and cumulative effects is problematic. Cumulative effects, especially trans-boundary impacts, have proved particularly difficult to assess in a rapidly growing sector.

Recommendations

The workshop concluded with a wide ranging discussion leading to a number of recommendations to improve the current situation. These have not been formally endorsed by delegates or their respective organisations but have been circulated for comment and represent the consensus of the meeting.

Environmental Assessment

Baseline Surveys

The time allowed for baseline surveys is unrealistic, leading to snapshot surveys rather than an ideal of at least two years prior to any development starting. However, it was also considered that there is too much focus on collecting broad data and not enough on smart use of data.

There is also acceptance that the current baseline is the norm and no recognition of past population declines.

Need for and use of surveys

The discussion considered whether there was need for detailed surveys if conditions such as shut down clauses were included from the start. If we have quieter technologies, do we need to focus so much on baseline or spend more resources up front on reducing impact?

Baseline surveys must be robust but also focussed. Better scoping, tied to possible impacts and future monitoring, is needed. Scoping should also include recommendation for methods of data analysis to allow direct comparisons with other schemes and to help cumulative assessment.

Projects must be designed with impacts and mitigation considered from the outset. Scoping can then be more intelligently focussed on surveys that will provide robust data that must be linked to post construction monitoring to inform of actual impacts.

We should have an aspiration for population recovery.

Regulation of assessment

The variation of approaches was discussed. For example, in the US the regulator carries out and pays for the environmental assessment. In the UK the developer does. The need for openness and public trust in the system was considered important. Which regulator is most appropriate, which approach works best and who regulates the regulator? (See also monitoring below)

Assessment should be carried out by independent, suitably qualified, third parties, paid by developers but answerable to regulators.

Cumulative Assessment

The problems of cumulative assessment were discussed. Lack of suitable methodologies, cross-sector impacts, commercial confidentiality of projects in the pipeline, can we do better at cumulative impacts in the original higher level assessments before leases offered? Should a developing programme of cumulative assessment be the responsibility of the regulator? It was also noted that

assessments need to be thorough and therefore cannot be undertaken rapidly. It was also noted that different areas will have different questions that need answering (and studying) and therefore one template will not work for all areas.

Regulators need to urgently address the issue of cumulative assessment. More research and development is needed in this field and it should include both inter-project cumulative impacts and cross – boundary impacts. In Europe, this means an EU approach. In other areas it needs to include dialogue between adjacent States.

Mitigation and impact reduction

Use of technologies

Discussions showed that mitigation is possible – bubble curtains can reduce displacement distances from 15km to 5km - and that the introduction on noise limits does work. Technologies other than piling, such as drilling and gravity base foundations, can also reduce noise impacts. The need to use the best available technology and to use the best mitigation, based on the application of noise limits, was generally agreed.

Noise limits should be introduced for all developments. How they are achieved is up to developers but there should be a presumption against piling in areas of importance to cetaceans. This needs to be closely tied to cumulative impacts.

Monitoring

Intelligent monitoring

It was agreed that monitoring is important to inform our knowledge of actual effects and to feed back into future assessments. However, there was concern that there was too much 'tick box' monitoring which, while costly, will not give useful data. For example, it was considered that there is little gain in monitoring porpoise at low densities as change could never be ascertained. Monitoring should be 'intelligent' and based on actual perceived impacts. It follows on the this should be thought about pre-application and that baseline surveys (see above) should be similarly targeted to inform post construction monitoring.

Monitoring must be built in to all projects in a 'cradle to grave' approach, from scoping, through baseline surveys to post construction surveys. All results must be publicly available to inform future schemes. Monitoring should be focussed where it can provide real information. There needs to be more linkage between 'monitoring' and 'research'.

Regulation of monitoring

As with ES, the approach of regulation differs. In the UK monitoring is imposed as a license condition to be carried out by the regulators. In Belgium monitoring is carried out by universities, contractors etc led by an independent committee but paid by developers. This approach, where monitoring could be targeted to specific impacts and where cumulative issues were also addressed was favoured.

Monitoring should be independent of developers (though paid for by them) and should be developed at a population level not based solely on individual schemes. Cumulative and cross-sector impacts need to be taken into account in developing monitoring.

Other points

The discussion raised several more important points but did not come to a conclusion on these. The key points were:

Prioritisation
How do we prioritise actions given limited budgets? Should we look at the investment required versus the magnitude of impact? BUT, for example, whereas fisheries may have more impact than noise it is perhaps (certainly within EU) more difficult to tackle.

Site based versus population level impacts
How do we tackle population level impacts for mobile species within a site based leasing and assessment process?

Is it acceptable to allow an impact if there is off-site mitigation (i.e. removal of another equal or greater impact nearby)?

Should we accept further noise in already noisy environments or should there be absolute limits?

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