Agenda Item 5.5.1

Implementation of the ASCOBANS Triennial Work Plan (2007-2009)

Review of New Information on Pollution, Underwater Sound and Disturbance

Anthropogenic Noise

Document 50

Technical Report on Effective Mitigation for Active Sonar and Beaked Whales

Action Requested

- Take note of the information submitted
- Comment

Submitted by

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ASCOBANS

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

26th March 2009

Dear Ms Frisch

Technical report on effective mitigation for active sonar and beaked whales

The European Cetacean Society (ECS) Conference was recently held in Istanbul, Turkey. The Annual General Meeting adopted the ECS Resolution on the need to regulate sonar mitigation following the Conference Workshop: Beaked whales and active sonar: transiting from research to mitigation, which was held on Sunday 2nd March. The AGM further agreed to set up a small Working Group of relevant experts to produce a technical report providing practical effective techniques to apply mitigation in order to reduce impact of active sonar on cetaceans.

Please find attached the resulting document of that Working Group entitled "Technical report on effective mitigation for active sonar and beaked whales". We would like to submit this technical report to the ASCOBANS Advisory Committee for consideration.

Yours sincerely

Sarah Dolman

ECS Workshop Chairs:

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TECHNICAL REPORT ON EFFECTIVE MITIGATION FOR ACTIVE SONAR & BEAKED WHALES

March 2009

Working Group: Sarah Dolman, Natacha Aguilar de Soto, Giuseppe Notarbartolo di Sciara, Michel Andre, Peter Evans, Heidrun Frisch, Alexandre Gannier, Jonathan Gordon, Michael Jasny, Mark Johnson, Irini Papanicolopulu, Simone Panigada, Peter Tyack, Andrew Wright

THE NEED FOR EFFECTIVE MITIGATION & REGULATION OF SONAR

There is evidence that active sonar exposure can have significant impacts on some cetacean species at relatively low levels (Evans and England, 2003; Evans and Miller, 2004). Beaked whales in particular are vulnerable to serious impacts including mortality from exposure to mid-frequency active sonar (1-10 kHz) (Jepson *et al*., 2003; Fernández *et al*., 2004, 2005; Jaber *et al*., 2005; Fernández, 2006; Cox *et al.,* 2006). This year, the ECS reaffirmed its 2003 Statement of Concern on Marine Mammals and Noise, noting further that the development of scientific knowledge since 2003 underscores the need for taking urgent action on sonar mitigation. Current mitigation efforts are generally untested and insufficient for beaked whales.[1]

Continuing evidence on the causal link between sonar and beaked whale mass strandings include spatio-temporal association between naval exercises and mortalities and consistent symptoms on necropsied whales pointing to an acoustic source as the most conservative primary cause of death/stranding (Evans and England, 2001; Jepson *et al*., 2003; Fernández *et al*., 2004, 2005; Jaber *et al*., 2005; Fernández, 2006). In addition, abundance estimates of local populations of beaked whales all indicate that populations are small (MacLeod *et al.,* 2009; Marques e*t al.,* 2009; Aparicio *et al.,* 2009; Baird *et al.,* 2009) and that the reproductive rates of some beaked whales may be low (Aparicio *et al.,* 2009; Aguilar Soto, 2009). Small, sometimes genetically isolated populations (Dalebout *et al.,* 2005) with reduced recruitment rates are particularly vulnerable to human impacts as they may have a limited capability to recover after trauma. This means that there is the potential for unsustainable losses of beaked whales to occur within relatively short time periods. The advances in our understanding of behavioural reactions of beaked whales to sonar (Moretti *et al.*, 2008; Tyack*., 2009*), in particular indicate that the ranges required for successful mitigation are in many cases going to be larger than feasible with current practices. This is compounded by the growing realisation of the potential for cumulative impacts arising from multiple exposures to sonar and/or in conjunction with other threats (e.g. Wright *et al.*, 2007a,b; Wright, 2009). The adoption of effective mitigation protocols, based on standardised guidelines and including technical measures only recently developed (Johnson*.,* 2009; Andre *et al.,* 2009; Gordon and Gillespie, 2009), is therefore a priority.

[1] While this workshop focused on the particular impacts of active sonar on beaked whales, we recognise that impacts from other sources, and on other marine species, may be significant and require appropriate mitigation.

Mitigation should be applied by all countries using military sonar in the three stages of sonar exercises: before (in the exercise planning phase), during, and after (i.e. reporting on effectiveness and adapting mitigation for future exercises) sonar use. Since sonar may have transboundary effects (Fernández *et al*., 2006), mitigation procedures need support at both international and national levels.

THE IMPORTANCE OF MITIGATION IN EXERCISE PLANNING

Current real-time mitigation efforts, whilst better than none at all, are either untested or known to be of extremely limited effectiveness, particularly for beaked whales. For example, the ship-board visual monitoring currently conducted by naval vessels during sonar exercises is considered to have vanishingly low probabilities of beaked whale detection, even in optimal sighting conditions (Barlow and Gisiner, 2006). This applies even with the most experienced observers and most suitable platforms, simply because beaked whales spend so much time below the surface and are almost impossible to spot except in calm conditions. Effective mitigation at the planning stage is therefore essential. Of these measures, a properly implemented system of spatio-temporal avoidance is, at present, the most effective way to reduce the impacts of active sonar on beaked whales and many other species (Agardy *et al*., 2007; Dolman, 2007; Parsons *et al*. 2008). Recent regional developments in beaked whale real-time detection and habitat modelling have improved our ability to identify important habitat (Cañadas *et al*., 2005; Kaschner *et al.,* 2007; Andre *et al.,* 2009). However, these models are often based on a limited dataset of the distribution of beaked whales. Models need to be considered with care to avoid interpreting lack of data as lack of beaked whale presence in little studied areas, and there is an important need to conduct detailed studies in a range of habitats and locations before extrapolating too readily from simple models.

Navies using active sonar should commit without delay to the following minimum procedures in exercise planning to reduce uncertainty to an acceptable level:

1) Navies should use field surveys and modelling to determine areas with low densities of animals, and without other risk factors (such as the presence of small resident populations), where exercises might be more suitably placed, as well as identifying ‘hot spots,’ where exercises should be avoided year-round or seasonally. Boundaries of such ‘hotspots’ should be regularly verified and adapted as necessary. Location of exercises needs to be planned with time to collect necessary information on beaked whales and other populations’ absolute abundance and an estimate of density in the area. It needs to be recognised that vast unsurveyed areas far from shore may be suitable beaked whale habitat (Barlow *et al*., 2006; Gannier, 2009). Within areas under consideration for sonar exercises, scientists and government authorities should collaborate on the following research and analysis:

a) ongoing collection of field survey data on the habitat use, abundance, distribution and density estimates of marine mammals in the area, including beaked whales, as well as on other biological and oceanographic variables. This includes a review of previous scientific knowledge and adequate new data gathered in any areas under consideration for siting exercises;

b) use of these data in a modelling context to make predictions of current marine mammal densities. Uncertainties in the detection function, environmental and correction factors for species with low detection availability (acoustic and visual), such as beaked whales, need to be incorporated into the models;

c) use of these data in tandem with models of acoustic exposure, bearing in mind the effects of certain oceanographic conditions (including the probability of surface-ducting conditions) on sound propagation, to make informed estimates of the numbers of impacts associated with each potential location and mode of operation. At the same time, the data should be used to identify risk factors other than density, such as the presence of small resident populations, that may be associated with certain locations; and

d) collecting additional field data and confirming conditions for sound propagation closer to the time of operations, for purposes of model verification and adaptive management.

2) Navies should identify a limited number of locations to which such exercises can be confined, with suitable monitoring, including passive acoustic monitoring (PAM) and mitigation measures in place. Until such time as reliable extensive surveys and models are available for a given region, navies should avoid important oceanographic features, such as canyons, steep walls, and seamounts, persistent upwellings, and bays, as well as Marine Protected Areas (MPAs), such as those created under EU Natura 2000 and the SPAMI protocol, and known high biodiversity or biologically relevant habitat.[2]

3) Navies should widely implement (and further develop) PAM, as an effective tool for identifying low-density areas in exercise planning and for real time monitoring of exercise areas. This acknowledges that whilst beaked whales are detectable for only 8% of the time when they are theoretically 'visible' at the surface – assuming suitable environmental conditions (where the encounter rate of beaked whales decreases by more than an order of magnitude as survey conditions deteriorate from Beaufort 1 sea state to sea state 5) and appropriate level of observation (Barlow and Gisiner, 2006; Barlow *et al*., 2001) – they are vocally active for 25% of the time when they are foraging at depth (Aguilar Soto, 2006). For towed hydrophones consideration should be given to the fact that acoustic detection range is only c. 1 to 5 km, depending on ambient noise and whale orientation with respect to the receiver (Zimmer *et al*., 2009) whilst beaked whales vocalise on average only 30 min every two or more hours. Thus, passive acoustic surveys have to account for the limited proportion of time – typically less than 25% – during which beaked whales are potentially audible with suitable equipment. Protocols for use of PAM detectors, including required actions when species are detected and how to deal with false alarms in different ambient noise environments, should be specified.

[2] To avoid potentially damaging ensonification within MPA borders, we recommend avoiding operating within an appropriate distance of MPA boundaries.

4) Navies should identify avoidance areas or environmentally preferred exercise sites within a transparent process that affords opportunity for public participation, as, for example, through an independently conducted Environmental Impact Assessment or Strategic Environmental Assessment framework.

5) Avoidance restrictions should apply to all types of exercises, including both strike-group level exercises, which involve multiple sonar arrays, and unit-level exercises, which involve single platforms; and should be defined in clear, unambiguous terms.

This strategic mitigation process, during the exercise's planning phase, will enable governments to make informed, transparent decisions about the comparative risks of exposure and determine the best locations for siting exercises. In general, during joint exercises between two or more navies, the more stringent mitigation measures should apply, even if these are not those of the host nation.

TOWARDS EFFECTIVE REAL-TIME MITIGATION

Standards should be developed that define an appropriate level of cetacean monitoring, depending on the species. To improve the effectiveness of real-time mitigation, such measures must reflect the challenges involved in detecting some of the most sonar-sensitive species, particularly beaked whales, as noted above.

Pursuant to a recent comparative review of current measures (Dolman *et al*. in press), we recommend that navies adopt the following measures for real-time mitigation:

1) Effective detection of cetaceans present in the exercise area:

- Monitoring with an appropriately designed array of visual and passive acoustic sensors in the exercise area during operation. Where available, on-range hydrophone networks should be utilised for real-time mitigation: otherwise, temporary hydrophone arrays of adequate size and sensitivity to reliably detect beaked whales should be used;
- Acoustic monitoring using transparent protocols for detection and classification of cetacean vocalisations. For beaked whales, on-range hydrophone networks and networks of temporary hydrophone arrays (including gliders, drifters, vessel based and bottom mounted platforms) are potentially useful methods upon which efforts should continue to be focused (Andre *et al.,* 2009; Johnson, 2009);
- Pre-sonar watch of a predetermined period (at least 2 hours for beaked whale detection) in which to provide the best chance to detect all available cetaceans visually (on board and where possible from aerial surveys) and acoustically;
- Use of dedicated and experienced and, where possible, independent marine mammal observers, trained to a minimum standard on visual and acoustic detection of beaked whales; and
- Assuming visual monitoring is maintained for the protection of other species, restriction of operation, to the greatest extent possible, to observable visual

conditions, such as during good light (during the daytime) and appropriate environmental conditions (including a sea state <3). Such restrictions should be prescribed for some types of sonar use (e.g. brief tracking exercises and sonar research, development and evaluation) even if they are not easily applicable to others (e.g. multi-day free play exercises).

2) Mitigation requirements once cetaceans are detected:

- Sonar power reduction and shut-down within conservatively defined radii to the greatest extent practicable around the sonar array, based on models of sound transmission (verified in local conditions) and of effects of sonar on sensitive species. For beaked whales (and likely for other species and situations), a conservatively defined radius would extend to the isopleth where the risk of significant behavioural effects becomes more than negligible (acknowledging that this might be beyond the radius of visibility in some cases); and,
- Suspension or relocation of activities where detections of potentially affected species are higher than predicted in pre-exercise planning. Suspension, relocation, or other restrictions are also warranted where detections of potentially affected species are higher than predicted in pre-exercise planning, or where unexpected oceanographic conditions such as surface-ducting would result in higher numbers of impacts than predicted.[3]

In short, as existing measures have very poor detection rates for beaked whales, measures that stand a greater chance of success for both detection and mitigation need to be identified.

TOWARDS EFFECTIVE POST-EXERCISE MONITORING

To improve the effectiveness of future mitigation efforts while also producing less disruption of operational activities, we recommend the following:

1) Post-exercise monitoring should include visual and acoustic cetacean surveys in the exercise area to compare with pre-exercise densities;
2) Transparent reporting to national authorities should occur within a predetermined timeframe, so that effectiveness and compliance to guidance can be monitored and appropriate adaptive management can be applied. The probability of detection at different ranges and the probability of false alarm should be considered and reported both for visual and acoustic monitoring. Other information provided should include visual sea conditions, experience and number of observers and type of binoculars or other visual aids used; background noise levels and number/spacing of hydrophones for acoustic monitoring; and types of detectors for classifying cetacean vocalisations; and, cetacean observations during post-exercise monitoring. It is also important that navies develop protocols for providing information on the tracks of vessels and specific areas of

[3] In regions where certain broad, dynamic conditions (such as surface-ducting) are unavoidable through planning, navies should adopt other mitigation (such as power-downs) to the greatest extent possible.

operations, which are necessary for a meaningful evaluation of effort relative to sighting rates; and,
3) Ongoing monitoring of populations (including of identified individuals), especially in areas of repeat exercises.

GLOBAL IMPLEMENTATION OF EFFECTIVE MITIGATION FOR SONAR

Recognising that sonar is used in all maritime areas, that many cetacean species are migratory or have large ranges, and that sonar pulses can propagate across boundaries (including those of protected areas),[4] countries have a responsibility to limit the impacts of their active sonar systems regardless of their location (including on the high seas) and preventing impact on fauna inhabiting waters of neighbouring countries. To this end:

- We are convinced that States must adopt and implement, via legal regulations, the measures indicated above as a matter of urgency;
- We welcome the work already done by international bodies such as CMS, ACCOBAMS, ASCOBANS, OSPAR and the European Community towards the adoption of mitigation measures, assure them of the support of the European scientific community, and encourage them to continue pursuing the issue;
- We believe that this issue must also be addressed by all relevant bodies engaged in the protection of the marine environment;
- We believe that there remains a need for international bodies to compile information on the mitigation protocols used by navies, including information on areas excluded from sonar use, and to make such information publicly available; and, to this end,
- We request all navies to publish their current active sonar mitigation programs and to inform the public on their ongoing effort to test and to improve their effectiveness.

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[4] E.g. exercises in international waters in 2004 resulted in stranding of beaked whales in two countries (Spain and Morocco) (Fernández *et al*., 2006).

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