

Underwater Sound & Marine Life Workshop
20th International Ship Operators' Meeting (ISOM 2006)
24th October 2006
Marine Institute, Ireland

Summary of Presentations

1. Mike Reeve, National Science Foundation, Virginia, USA
Recent Developments in NSF, Presentation on the new RV Langseth

Mr. Reeve spoke about the seismic vessel purchased by the NSF in August 2004 (\$6.2M), which was subsequently renamed the R/V MARCUS LANGSETH. The NSF also purchased \$6M worth of seismic equipment. The vessel is currently in the shipyard undergoing modifications but it is expected to be in service in 2007.

Mike went on to speak about the environmental compliance which is associated with NSF-funded research. The requirement for compliance applies to all Federal actions, and the evaluation of environmental impacts is part of the planning process.

Three responses are issued:

- action excluded (Categorical Exclusion)
- action may have impacts (EA)
- action is 'major' and/or will have impacts (EIS)

Mr. Reeve also spoke about prior interagency efforts on the subject of the effect of underwater noise on marine mammals. Agencies involved included NOAA, the U.S. Navy, NSF and the Marine Mammal Commission. Recent reports on the subject published by the include the following:

National Research Council (National Academy of Sciences) – “Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects”.

Natural Resources Defence Council – “Sounding Depths II: The Rising Toll of Sonar, Shipping and Industrial Ocean Noise on Marine Life”.

Office of Marine Programs of the University of Rhode Island – “Discovery of Sound in the Sea”.

Mike also spoke about the actions which the U.S. Government have taken to date which include the establishment of the Commission on Ocean Policy in 2000 and the Committee on Ocean Science and Resource Management Integration (ICOSRMI) in 2004. In 2006, ICOSRMI formed an Interagency Task Force to prepare a collaborative blueprint and report in November 2006.

Mr. Reeve outlined sources of funding for future research in the U.S. comprising the National Ocean Partnership Program (\$4 million) and the Joint Industry Project (International Association of Oil and Gas Producers) providing \$8 million per year for 5 years. A further \$20 million funding is under consideration by the U.S. interagency group.

2. Dr. Oliver Ó Cadhla, University College Cork
Sound, Science and Sense - Protecting marine mammals in Irish waters

Dr. Ó Cadhla spoke about the aspects of sound in the ocean which are relevant to marine mammals, these include:

Frequency (Hz)

Intensity/Pressure in water (dB re 1 μ Pa @ 1m)
Duration (seconds or milliseconds)
Duty Cycle (%)
Bandwidth (Hz)
Directionality (omni-, vertical, horizontal)
Energy output (Watts)
Persistence (temporal, geographic scales)
Depth and seafloor characteristics

He also spoke about the characteristics (intensity, pulse energy, duration etc.) of some of the sources of man-made underwater noise which included Super Tankers, Military Sonar (LFA/SURTASS or 53C), Airgun Array (2000 psi and 8000 in3), Multibeam, Fishing vessels (12m long @ 7 knots) and acoustic deterrent devices.

The possible effects of noise on marine mammals are:

Physical: Non-auditory and Auditory (e.g. TTS, PTS)
Perceptual: Masking communication/interpretation
Behavioural: Modification, Displacement, Social disruption
Chronic: Stress, Immunosuppression, Desensitisation
Indirect: Prey availability, Physiological changes

Dr. Ó' Cadhla outlined the legislation currently in effect in Ireland. All marine mammals are protected under the Wildlife Act 1976, 2000, and certain species (Annex II and Annex IV) are protected under the EU Habitats Directive 1992. The main objective of the Habitats Directive is to achieve and maintain the "favourable conservation status" of the annexed species. "Favourable conservation status" means that the population dynamics of the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitat; the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future; and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Oliver outlined the NPWS Guidelines for Irish waters entitled "Mitigating measures for the protection of marine mammals during acoustic seafloor surveys within Irish waters" which are being developed in consultation with JNCC, PAD, GSI, Marine Institute, IWDG and UCC. These guidelines will be mandatory for all seismic surveys and acoustic surveys in SACs, and will form 'best practice' for estuaries, inlets, bays – to 1.5km. Dr. Ó' Cadhla outlined the requirements within the guidelines with regard to carrying out seismic, multibeam and side scan sonar surveys. He concluded by saying that the mitigation measures are currently being finalised and therefore a precautionary approach is required.

3. Simon Berrow, Irish Whale & Dolphin Group Acoustic Surveys & Cetaceans in Ireland: Background & Current Issues

Mr. Berrow opened by outlining recent incidences where the IWDG had voiced their concerns over the impact of active acoustic surveys. He discussed Irish responsibilities as regards maintaining high cetacean species biodiversity, the offshore exploration industry as well as Irish legal obligations (Habitats Directive, Wildlife Act, OSPAR Convention). Simon pointed out the recent preliminary opinion of the Advocate-General Leger of the European Court of Justice EU: which "criticises Ireland for failing to put in place a comprehensive, adequate, ongoing monitoring programme for cetaceans". In order to mitigate against the impacts of acoustic surveys the source of the noise needs to be identified. Acoustic surveys carried out within cSACs should be subject to the most stringent levels of mitigation including pre- and post- survey monitoring. Those carried out outside cSACs and in Biologically Sensitive Areas should follow appropriate NPWS approved mitigation procedures.

Mr. Berrow outlined some of the main points from the publication entitled “The Impact of Multi-beam on Cetaceans: A Review of Best Practice” (O’Brien & Berrow, March 2005), which included recommendations from the German and American Governments.

Simon reported on some unusual stranding events in Ireland, the U.K. and Canada. Unusual strandings have increased greatly in the latter half of the 20th century with the most rapid increase occurring off the Scottish coast. Mr. Berrow offered the following possible explanations for the increase:

- Increase in reporting
- Changes in distribution and migratory patterns
- Increased mortality
- Nutrition and toxic contamination
- Industrial activities
- Military activities

Mr. Berrow also spoke about the sub-lethal effects of underwater noise which included displacement or exclusion. He concluded by proposing that the following issues need to be considered in relation to mitigation:

- Employ techniques with measurable effectiveness
- Monitor implementation and effectiveness of guidelines
- Procedures and protocols should be conservative and reflect uncertainty
- Risk matrix
- Passive Acoustic Monitoring (in poor weather/visibility)
- Need to Identify Critical Habitats and Seasons
- Causes of Death (Post Mortem Analysis)

4. Dr. Carl Donovan, University of St. Andrews OSH in the Ocean: Quantifying the effects of sonar on marine fauna

Dr. Donovan began by speaking about the SAFESIMM Project which aims to develop software & data to advise on the potential risk to marine fauna from naval sonar. The software will also form the basis of risk mitigation decisions. Carl went on to talk about methods of quantifying sound dose as well as quantifying effect of sound dose. Quantifying the sound dose is a relatively easy task, whereas it is very difficult to accurately quantify the effect of or response to sound by cetaceans. Physics models can be used to give sound pressure predictions for 3 dimensional locations in ocean in order to quantify the sound dose. The response to sound or “enonification” can be physical and behavioural.

“Stand-off ranges” can be implemented on vessels as a mitigation measure. This involves setting an area about vessel determined by threshold level where the risk of biological consequences are deemed to be particularly high. However there are limitations to this method as the cetaceans may not always be detected. The probability of detection decreases with distance, it varies across observers and conditions and also varies by species. In addition, observers can never be totally certain that a given monitoring zone is clear.

Dr. Donovan spoke about the implementation of the SAFESIMM software. The density estimates within SAFESIMM are based on models and survey information. The vertical distributions are inferred from functional analysis of tag data and/or simplistic models of dive behaviour, and random components add various movement types through time. SAFESIMM employs a simulation-based approach where large numbers of simulated animals imparted with approximate real-life movements sample the sound field. The software also considers “what-if” scenarios within bounds of the information provided. The distributions or

movements vertically are estimated from empirical data whereas the horizontal movements are governed by species specific rules.

SAFESIMM provides “real time” data in several minutes to multiple sound sources. As well as being adaptable for future developments it is envisaged that it will eventually be globally applicable. Carl also spoke about the limitations of the system which include the fact that the data requirements are extensive. There are still many unknown factors to be considered such as the fact that many species are poorly studied (e.g. rare or difficult) and most available estimates are based on a relatively small amount of data.

Carl concluded by saying that using the simulation tool within SAFESIMM allows the user to pre-plan to avoid high risk areas as well as to determine/amend the sonar characteristics for lower risk, yet still allow acceptable functioning.

5. Dr. Sam Healy, QinetiQ Environment Team, QinetiQ Environmental Protection – Examples from the UK Navy Approach

Dr. Healy began by stating that there is a very wide ranging and diverse group of stakeholders associated with the area of marine environmental protection. These would include representatives from the Shipping, Fishing and constructions sectors as well as research and defence.

There are many different sources of underwater noise. Natural sources include wind, wave action, shore/surf, precipitation and spray and biological noise, whereas man-made causes comprise the likes of vessel traffic noise and noise coming from construction. Man-made noise levels have been increasing which has led to growing concern from NGOs (Non-Government Organisations) and a call for regulation in order to protect the environment. Sam pointed out that although measures already exist which prohibit the ‘disturbance’ of cetaceans, approaches to mitigation vary internationally and it is likely that further measures will be adopted within the next few years.

As regards the UK defence community, Dr. Healy outlined the Policy Statement by the UK Secretary of State for Defence which states:

- “Comply with all relevant applicable legislation (including legislation giving effect to the UK’s international obligations).”
- “Overseas, we will apply UK standards where reasonably practicable, and in addition comply with relevant host nations’ standards.” Relevant UK legislation on the issue includes the Wildlife and countryside Act, the Habitats Directive, UNCLOS, OSPAR, the Bonn Convention, ASCOBANS, ACCOBAMS and the new Marine Bill. Sam further commented that future regulation of active sonar could potentially take the following forms: Exclusion; Restricted Semi-Permanent Moratoriums; Modified Operation; Permitted Use.

Dr. Healy went on to outline the UK Ministry of Defence approach to environmental impact assessments stating that there is a requirement to carry out EIAs for sonars, ranges and survey vessels.

The basis of mitigation procedures are to:

- Plan
- Look, Listen
- Act
- Audit Trail (Records)

As regards visual monitoring of cetaceans Dr. Healy pointed out that although a limited amount of equipment is usually required, often there can be poor visibility. In addition, the animals are only visible at the sea surface. Working conditions can also often be very uncomfortable or hazardous.

Sam commented that the way forward as regards mammal mitigation involves requires further research and training. Further research into marine mammal distribution, monitoring and risk management is required. Training in the areas of our environmental obligations, environmental impact assessments and environmental monitoring also needs to be carried out.

In conclusion, Dr. Healy reiterated that point that there are growing concerns about man-made noise in the oceans which has led to calls for regulation and legislation within the field. However before this can be achieved further research is required in order to fully understand all of the risks involved. She also commented that any mitigation measures put in place must be robust and proportionate, and should encompass 'best practice' procedures.

6. Mr. Geraint West, UK Ocean Research Services Sound in the Marine Environment - Why does it matter to Research Vessel Operators

Mr. West began by listing the various international laws and conventions pertaining to marine noise pollution, these include the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the 1946 International Convention for the Regulation of Whaling (ICRW) which specifically mentions concern over potentially adverse effects of anthropogenic noise on cetaceans. He next mentioned how some RVs have received negative attention in the press in regard to harming marine mammals and gave examples of same in the form of news items in the US press.

Mr. West next dealt with the impacts on RV Operators, he mentioned the financial and time implications of planning a seismic survey, it now takes 12 months to organise a seismic cruise in the US and he also pointed out that we still don't know how well mitigation measures work and that there is circumstantial evidence that a variety of other acoustic instruments may also have effects on marine mammals.

The next slide listed the various noise sources and their peak frequency – the highest of these were multibeam (echosounder hull mounted) at 12,000 Hz, acoustic harassment and acoustic deterrent devices both at 10,000 Hz peak frequency.

The next item dealt with general mitigation practices such as:

Use of minimum level to achieve intended scientific result, use of 'soft starts' whereby power is increased gradually over periods of >20 mins, equipment should be shut down if cetaceans are observed within a potentially harmful distance of the vessel, surveys should be planned to minimise repeated surveying of areas in consecutive years with high risk equipment. A general rule of thumb recommended by the Royal Navy is Plan, Look, Listen, Act. Mr. West also referred to JNCC's guidelines and recommendations arising from a NERC workshop and a IACMST Working Group report on Underwater Sound and Marine Life which recommended that the UK, with EU and international partners where appropriate, should build a modern, regulatory, risk-based framework relating to noise in the marine environment, based on existing legislation and the application of the precautionary principle. Its purpose should be to provide agreed impact/harm criteria, eliminate confusions over terminology, and enable more consistent mitigation measures.

The Royal Commission on Environmental Pollution recommended the large-scale network of MPAs and reserves to benefit the environment and fisheries, that 30% of the UK's exclusive economic zone should be protected and financial assistance for fishing during transitional

period. The OSPAR commission agreed in 2003 that a network of MPAs should be developed by 2010.

Mr. West next referred to and showed a map of the ASCOBANS & ACCOBAMS, these are the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas, 1991 (ASCOBANS) and the Agreement on the Conservation of Cetaceans of the Mediterranean and Black Seas, 1996 (ACCOBAMS). He described the procedure involved in submitting an ACCOBAMS permit proposal in detail. The main information required is; a description of the activity to be carried out, the research protocol – in case of scientific research on marine mammals additional data is required, an environmental impact assessment is required and certain mitigation procedures are to be adopted.

Mr. West outlined the NURC (NATO Undersea Research Centre) checklist in relation to marine research. The main steps are:

- Research any previous studies of the area
- Itemize details of high-level sound sources
- Perform modelling estimates
- Consult with the SOLMAR project
- Prepare the request for permission
- Assess the impact of the high level sound on each of the environmental elements
- Determine/confirm visual and acoustic monitoring requirements
- Maintain audit trail of all environmental precautionary activities.

He also showed an example of NURC's Environmental Scoping Study Matrix which captures information like the type of activity taking place e.g. use of acoustic sources, explosive charges, seismometer and the ecosystems they could have a likely impact on e.g. marine animals/biological habitat.

Mr. West gratefully acknowledged the assistance from Roland Rogers and Sam Healy of Qinetiq in the preparation of his presentation.