CORRELATION OF UK CETACEAN STRANDINGS AND MOD AMBIENT NOISE DATA

D. Toogood National Oceanography Centre, Southampton, UK

1 INTRODUCTION

The aim of this project is to examine levels of marine ambient noise and its relationship to strandings of cetaceans within the waters of the United Kingdom. This study also attempts to address the issue of scarcity of long term environmental and biological data[1,2] by utilising two previously uncorrelated datasets. It is hoped that the project could supplement ongoing research into the impacts of anthropogenic noise upon cetaceans and its role as an environmental stressor[3]. Ambient noise data was provided by the United Kingdom Hydrographic Office and UK stranding data was provided by the UK Cetacean Strandings Investigation Programme (UKCSIP). Bothsets of data were funded by DEFRA and the UK Devolved Administrations.

2 DATASET CORRELATIONS AND RESULTS

2.1 Ambient Noise

Ambient noise data was collected by sonobuoys deployed by Ministry of Defence maritime patrol aircraft on six discrete frequencies; 55 Hz, 100 Hz, 305 Hz, 440 Hz, 850 Hz and 1150 Hz. Three main study sites were identified by clusters of sonobuoys, allowing for site comparison; the first along the Devon and Cornish coastline between St Ives and Buckland, the second in the North Sea between Aberdeen and Newcastle and the third in north west Scotland along the Minches. During the period of study from January 1999 to December 2009, a total of 2715 ambient recordings were taken and 9429 strandings of cetacean were observed. The strandings database was filtered to present a subset of potential acoustic strandings, diagnosed causes of mortality such as fisheries by-catch and ship strikes were removed. The remaining dataset included either undiagnosed causes of mortality or events which could be attributed to acoustic related causes such as gas embolisms[4] or reduced immune responses[5] functioning as an indicator of stress. Each of the three clusters of sonobuoys were plotted onto a Arcview GIS system and a buffer was created at a 75km range around each point. This buffer would then represent a maximum distance for acoustic behavioural responses[6]. Data was then entered into a matrix to match acoustic events to strandings over a 10 day time window. From this matrix 505 events were identified; 209 within the South West region, 167 from the North Sea and 129 from the Minches Correlated events were examined to identify species that are known to be acoustically sensitive and vulnerable to impacts of anthropogenic noise. These events which had sufficient preceding measurements could be plotted to investigate whether exposure to periods of high noise levels could induce a stranding. Figure 1 demonstrates a possible acoustic event, with ambient levels reaching 90 dB re 1 µPa over a 10 day period before two strandings of *Physeter catadon* (Sperm whales). Sea state was also examined to ensure that wave action did not significantly influence ambient recorded levels. Mean sound pressure levels at the three sites were found to show minor increases notably within 55 Hz and 100 Hz. However, all frequencies were subject to fluctuation and could not be deemed significant. The select frequency at 440 Hz which contained the lowest number of observations did not produce adequate results to be included. A steady decline in sonobuoy deployments and therefore acoustic data was observed from 2001 onwards. It is noted that at the time of writing this abstract, some analysis was still being conducted upon the ambient noise data as part of a corresponding MSc thesis and could not be included in its present form at this time.

2.1.1 Stranding Composition

Numbers of recorded strandings were found to increase within all three regions during the course of the study. The South West site showed the highest rise at 50.8% from 1999 to 2009; this also included a peak of 291 strandings recorded during 2003 and 230 during 2004. Investigation of this peak showed 54% of events were strandings of *Delphinus delphis* (Short-beaked common dolphin). This species is not known to be sensitive to acoustic events and therefore its high prevalence within the stranding record is believed to be due to its abundance within the near shore waters of the study site[7]. The North Sea region showed a 27% increase peaking at 2005 with a total of 893 strandings with 75.47% of strandings associated with harbour porpoises. Though an acoustically sensitive species its high abundance, as with the *Delphinus delphis*, is believed to be the significant factor. The Minches site showed the lowest increase at 36% increase peaking in 2007 and 2008 with a total of 606 strandings. However its species composition included significantly higher number of known acoustically sensitive species compared to the other two sites, including species such as *Ziphius cavirostris, Mesoplodon bidens* and *Physeter catodon*.

The use of these two datasets has been able to provide a small snapshot into the ambient acoustic environment in which UK cetacean species reside. It is believed that the use of sonobuoys provides a fascinating insight into the relationship between ambient marine environment and its role in acting as an environmental stressor. Though project synthesis has produced some relevant results, the project could be enhanced with developments in programming and geospatial techniques, which would then allow for a more powerful analysis and interrogation of the datasets.

3 REFERENCES

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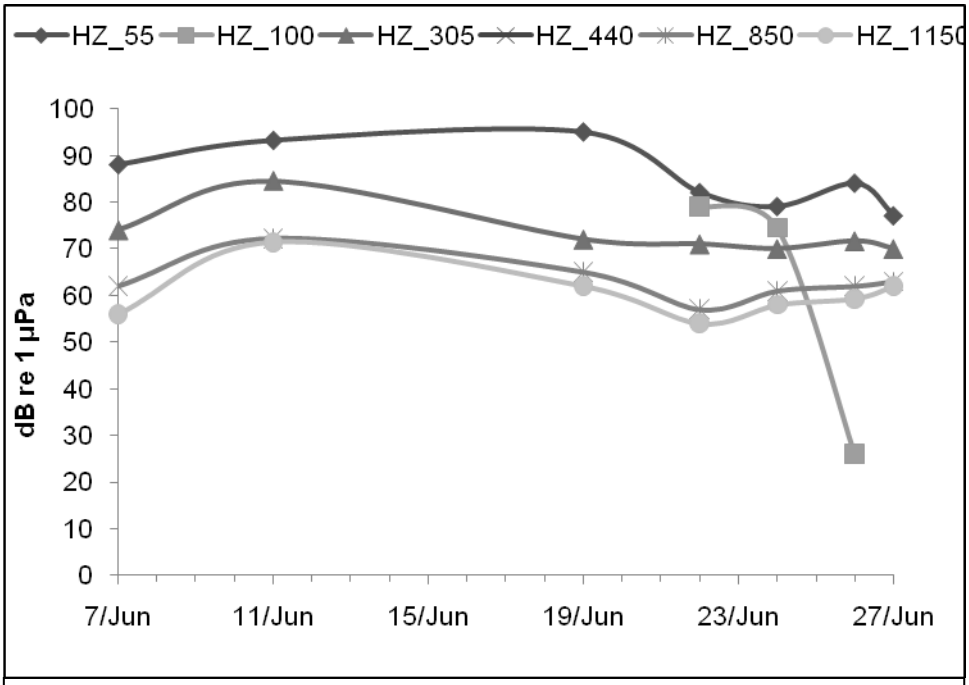

Figure 1: Ambient sound pressure levels (dB re 1 µPa) during two stranding events of *Physeter catodon* (Sperm Whale) off the Minches in North Western Scotland. Stranding are identified by the dashed lines. SW2001/124a occurred on 17/06/01 and SW2001/127b 21/06/01.

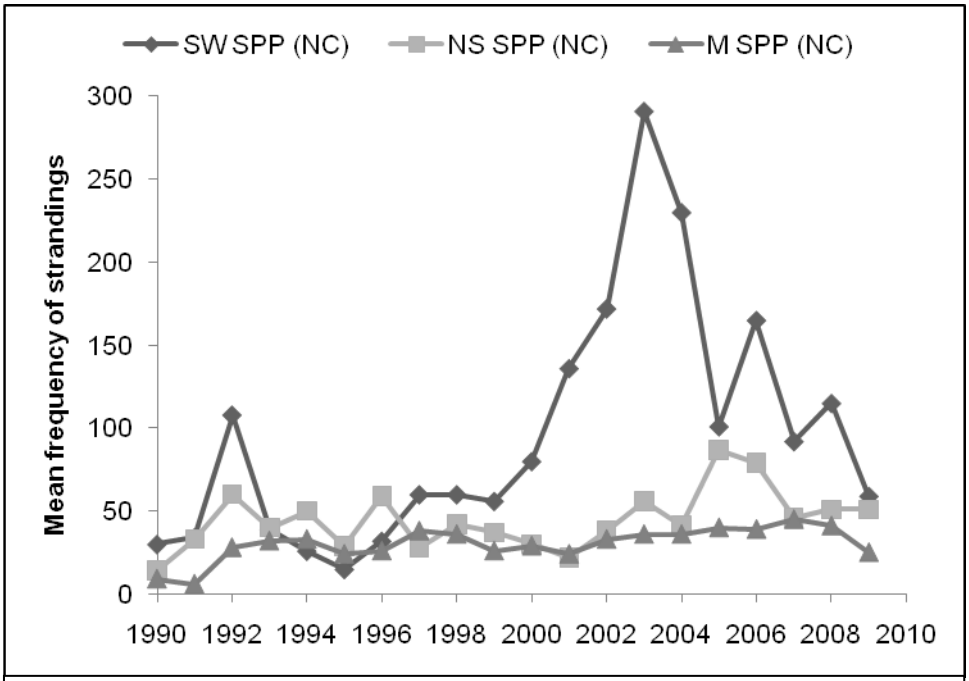

Figure 2: Comparison of total strandings between the South West, North Sea and Minches study sites between 1990 and 2009.