

Avoidance as a conservation strategy for spatio-temporal management of anthropogenic sound sources

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INTRODUCTION

The three main standard methods used to mitigate the potential impacts of airgun and sonar sound on marine mammals are:

1. Implementation of operational procedures (e.g. 'soft start' – where sound levels are gradually increased over time);
2. Implementation of real-time mitigation measures (e.g. shut-down); and,
3. Time/area planning of surveys to avoid marine mammals.

There is considerable variation in operational and real-time measures and species included in seismic mitigation guidelines (Weir and Dolman, 2007), and relatively little mitigation has a firm scientific basis and proven efficacy in the field. Moreover, there is currently a total lack of effective real-time mitigation at night/poor weather, or for elusive species such as *Kogia* and beaked whales (Barlow and Gisiner, 2006).

DEFINING KEY MARINE MAMMAL HABITAT

Key habitat is usually described as breeding, feeding and migrating areas, definitions that are most readily applied to baleen whale species. Other cetaceans e.g. oceanic odontocetes may be wide-ranging and inhabit ill-defined or poorly surveyed key habitat. Yet seismic and sonar activities are permitted to continue in such areas due to the lack of year-round scientific data to prove marine mammal usage. Some areas are known to contain high densities of a range of species, for example shelf edge habitat in the Bay of Biscay and the Gulf of Mexico. Such areas should be avoided for anthropogenic sound use.



Spatio-temporal management in action

An unprecedented 50 nautical mile moratorium extends around the Canary Islands for protection of its marine life from naval sonar, following repeated whale strandings and resulting public pressure. Strict seismic survey closed seasons are implemented in Brazil where prohibited areas exist for breeding humpback (Jul–Nov) and southern right whales (Jun–Dec), nesting areas for marine turtles (Oct–Feb) and manatee habitat (Sep–May, some areas permanently closed) (IBAMA, 2005).

ONGOING MANAGEMENT

Management solutions for wide-ranging species require international consideration, and must be collaborative and multi-faceted. Naval sonar and seismic surveys must be managed in domestic waters, areas repeatedly (including bi-annually) surveyed, and in the high seas. Management should be integrated into early planning stages and stated clearly in governmental licensing documents for maximum effect.

CONCLUSIONS

- Time-Area closures should be implemented case-by-case
- Predictive spatial modeling of key habitats is a new and powerful tool that may assist in establishing closed areas
- Long-term field data is the most appropriate method of determining 'key' marine mammal habitat
- The most effective and precautionary mitigation technique to avoid potential impacts of anthropogenic sound on marine mammals is spatio-temporal management to avoid densities of, or particularly vulnerable, marine mammals.

DEFINING KEY MARINE MAMMAL SPECIES

Species (or populations) considered vulnerable, endangered or critically endangered by the IUCN should merit particular attention. For example, seismic surveys are permitted in the only known feeding ground of the critically endangered Western gray whale off NE Sakhalin Island (Weller et al., 1999), and the NW Atlantic breeding grounds of the endangered northern right whale are proposed US Navy military sonar trial sites. When an area is used by a nationally/ internationally high proportion of a threatened species, e.g. Northern bottlenose whales in the Gully, Nova Scotia, it should be considered key habitat and protection implemented.

TEMPORAL VERSUS SPATIAL

- Effective mitigation begins at the survey planning stage
- Sensitive areas are rarely clearly defined in existing guideline
- Spatio-temporal avoidance of key habitat remains the most effective, precautionary measure to protect marine mammals from sound
- Spatial avoidance of a particular geographical area is relatively straightforward
- Temporal avoidance (where a closed season is implemented at times when marine mammals inhabit the area) requires detailed management plans based on scientific surveys
- User funding should be forthcoming to conduct the necessary surveys



Time-Area closures to anthropogenic sound use have been implemented in some regions to protect breeding populations of humpbacks and turtles.

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