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Working Group II: Marine Mammal Surveillance and Detection

Report by Peter M. Scheifele[1]

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INTRODUCTION AND BACKGROUND

Understanding that noise and loud sounds can have detrimental effects on animals (YOST 1994, KRYTER 1994, RICHARDSON et al. 1995, COWAN 1994 cited in the contributions), detection and monitoring measures are often taken as an integral part of undersea research operations with regard to the protection of marine mammals. Detection and surveillance of marine mammals for the purpose of protection against the detrimental effects of noise during research operations is a "mission specific" task that may require different types and levels of monitoring. The types and levels of surveillance will be dependent on the nature of the sound source (e.g. airguns and multibeam sonars versus ship-hull mounted ADCPs, etc.).

The types of surveillance discussed in this workshop were primarily visual and acoustical and addressed only monitoring with respect to marine mammals during geophysical and oceanographic research operations in the Antarctic.

This group did not specifically discuss research and development into the use of deployable active surveillance systems but centered the discussions on the immediacy of needs to facilitate the conduct of Antarctic research specifically from the R/V "Polarstern" in the marine area south of 60 °S in which the provisions of the Protocol to the Antarctic Treaty on Environmental Protection apply.

TOPICS CONSIDERED

The members of this group agreed that regarding the two methods discussed as being the most practical means of surveillance, the protocol used should depend upon the type of operation and the levels of noise produced by this operation ensuring the highest level of safety for marine mammals according to the regulations of the Protocol on Environmental Protection to the Antarctic Treaty. It should always be remembered that marine mammals have to surface to be seen and marine mammals have to be vocalizing to be heard. This limits the type and duration of surveillance possible. We should encourage better sharing of information and technology in connection surveillance and monitoring techniques. The following topics were considered.

1. Which types of surveillance (acoustical and/or visual) are appropriate?

The agreed methodology for conducting surveillance operations during scientific missions should be as follows:

- Define the scientific operation;
- Define what type, if any, surveillance is needed depending on noise sources;
- Define the appropriate range of survey from own-ship with regard to the sonars/equipments being deployed;
- Use standardized protocols as practical.

2. Why aren't surveillance protocols standardized among participating nations and should they be? What rules should be employed to guide the chosen surveillance protocols?

Experts are advised to compare and review examples of guidelines for surveillance from UK, U.S.A., Germany, Australia, New Zealand and others to determine which elements of each countries guidelines are applicable to mitigation in Antarctica with respect to regulations of the Protocol on Environmental Protection to the Antarctic Treaty. The group felt that there is a definite need to standardize surveillance protocols especially with regard to the number of hours (daylight / nighttime) of watchfulness and what actions are to be taken if an animal enters the operating area (that is, is seen or heard). We should encourage better sharing of information and technology in connection surveillance and monitoring techniques.

Guidelines for visual observations should include review of:

- Somebody onboard vessel must be responsible for marine mammal observations.
- Observer quality including experience, training of observers; observers should be of a certain standard or having undergone a level of training.
- Should we always have a dedicated MMO or should existing crew do visual observations (assuming the crew members who are serving as observers have been properly trained and can be spared from their normal duties).
- Number of observers onboard; what frequency should they be changed on. Length of watch changes observer efficiency. How many people can you realistically get onboard a vessel?
- Should other platforms be used for observing marine mammals such as helicopters and fixed wing aircraft, small boats? A decision should be undertaken for each operation whether more than visual observation from the

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main vessel should be undertaken. Limitations and drawbacks of using other platforms. Will use of helicopters etc. just generate more noise and put people at risk? Helicopters will generate noise and animals will react to it, but if it passes on a track the effect will be for a short time only. Should you look further, than just where the radius of visibility to watch for reactions from marine mammals.

3. What are the limits of visual surveillance at present?

The working group considered each specific type of observation separately. Under what situations is it more appropriate to have one or the other form of surveillance or should we always use both. This should depend upon the type of operation and the levels of noise produced by this operation, however the general consensus was that we must optimize and encourage acoustic detection technologies. We should continue to encourage the advancement of technological methods for the surveillance and identification of marine mammals. In addition, we should encourage better sharing of information and technology in connection surveillance and monitoring techniques.

Limits for visual observations that were discussed include:

- Degree of ice cover,
- Sea state,
- Visibility - fog and rain and snow and glare,
- Height of observation platform,
- Distance to horizon (based on height of eye, which can vary by platform)
- Communication links between operations managers and marine mammals observers (MMOs) especially if MMOs are not onboard the main vessel
- Darkness - at night do you stop use of acoustic-sources?
- Ensuring reports of MMOs are submitted and analysed.
- Frequency of relief of visual observers (visual detection threshold); generally the maximum a person should be observing is two hours.

Aside of these limitations there is a problem with determining how many observers should be posted during operations and the level of training they have. Although it was not considered in the discussion, the matter of berths available and the financial stress on the grants paying for the research must be considered, the former being more critical than the latter. The common use of MMOs as "data collectors" (for example in making bird counts) could yield useful biological information if the surveys are well designed, although the extent to which this can be done is debatable.

4. What kinds of acoustic devices are available with respect to requiring surveillance?

Keeping in mind that we can only detect and classify marine mammal signals when there are significant differences in frequency and time domain from the noise. We currently do have some knowledge of animal vocalizations but it is very limited as there are no fully operative classification systems in existence. The knowledge is largely from local recordings and is mostly based on visual inspection of sonograms. We also need precise information as to ship and equipment signatures. These will vary according to ship and towing speed and sea state. In addition, determination of range to an animal or animals is difficult unless an active source is used. This group does not recommend the use of active sources for surveillance.

Three main acoustic devices currently exist:

1) Single hydrophone
   - Hydrophone through moon pool (a movable system that can drop down into moon pool.);
2) Towed Array
   - Integrated array in the streamer is possible;
   - Direction available using multi-array;
3) Sonobouys
   - Would serve best outside disturbing noise sources.

5. What are the limits on acoustic surveillance at present?

1) Single hydrophone
   - Hydrophone is onboard vessel, noisy ship will mask the ability to detect the animals.
   - Hydrophone cannot be placed over side due to ice.
   - Hydrophones through moon pool have to clear ship. But anything placed horizontally below ship perhaps (0.5-1 m) subject to risk of colliding with ice etc. But perhaps it should be risked - barrel sonar could be used but needs to be a couple of meters below ship.

2) Towed Array
   - Only one streamer can be towed due to ice cover.
   - Integrate array in streamer is possible but not practical.
   - Directionality is available using a multi-array. Directionality is limited to some degree but not which side of vessel.
   - Need to analytically process the data from hydrophone array.

3) Sonobouys - Would serve best outside disturbing noise sources.
   - Cannot perform species identification.
   - Sonobouys would place a major expense on operation.
   - Logistics of placing sonobouys - using helicopters.
   - Sonobouys need to be picked up.
   - Use sonobouys for a particular type of research. Small-scale, high-resolution survey, for instance over a 4D survey is not practical for a 1000 km line survey.

During missions involving parametric or multibeam sonars the limitations of acoustical surveillance may become even more limiting for the following reasons:

- Entanglement, if you have gear, cutting off by ice and combining it with equipment.
- During combined operations biological equipment is being changed all the time.
- Is it possible to build systems into all this rapidly changing gear?

  Gear that is towed on bottom increases chance of losing hydrophones if attached
- Acoustic Interference, net sounder on a trawl.
- Ice cover up to 50 % with sturdy gear is probably the maximum the equipment can withstand.
- Bottom gear is very noisy- causing acoustic interference.

• It may be possible to attach hydrophones to net equipment etc., but one must remember it is VERY COLD. One option is to use tape etc. to attach hydrophones to equipment. This will have only limited success.

GROUP COMMENTS ON POSSIBLE SONAR SURVEILLANCE SYSTEM PROPERTIES

We currently have the ability to use passive towed systems with a frequency range of up to 300 kHz. We are assuming that we need to make detections in the range of 12 Hz to 150 kHz in order to cover the entire suite of animals that may possibly be encountered during science operations. This will be difficult (in the limited frequency range of interest) due to ship noise masking the animal signals in the desired 3-dimensional surveillance radius of detection. Hull-mounted systems will have an even tougher time with these effects.

Use of the hydrophone in the moon pool or even to hang one over the side requires the ship to be stopped, which severely impacts the science operations. Moreover, since the ship noise will be the dominant signal doing either of these things is moot. In addition there is no capability to "look ahead".

Reference was made to both the Ocean Ear and Rainbow Click systems, however it was the general consensus these systems have not adequately resolved the afore-mentioned issues so as to be useful. It was clear that we must push harder to advance eco-surveillance technologies. The "bottom line" is that there is NO guarantee that all animals will be adequately detected using either visual or acoustical surveillance techniques.