1. INTRODUCTION

The planning for the 2010 Astokh and 2015 Piltun-Astokh 4D seismic surveys represented a major investment of time by the Western Gray Whale Advisory Panel (WGWAP), Sakhalin Energy and the Seismic Survey Task Force (SSTF) and Noise Task Force (NTF) of the WGWAP. The 2010 MMP continues to be one of the most complete whale-focused Monitoring and Mitigation Plans (MMPs) developed for a seismic survey anywhere in the world\textsuperscript{1}. The 2015 MMP is based on the 2010 MMP.

The fundamental rationale behind the mitigation component in 2010 was:

1. design ahead of the survey:
   a. minimise the area surveyed.
   b. minimise the sound levels reaching the expected areas of highest density of whales.

2. measures during the survey:
   a. carry out the survey as early as possible in the season, i.e. when fewest whales are present;
   b. incorporate measures to stop the survey when needed to protect whales present.

During the early stages of development of the 2010 MMP it became apparent that there were very few data available on the effects of noise on gray whales, especially when feeding. It also became apparent that much of what is considered as ‘best practice’ mitigation has rarely, if ever, been properly evaluated. Monitoring was quickly recognised to be an essential component of the planning for the 2010 survey, both to evaluate the effectiveness of the mitigation component of the plan to see if practical changes were required and to ensure that future MMPs could be based on stronger scientific information than was available to the Seismic Survey Task Force (SSTF) in drawing up the 2010 MMP.

This document incorporates changes to the 2010 MMP that are applicable to the planned 2015 seismic survey. The 2015 Sakhalin Energy survey will be conducted offshore Sakhalin, covering an area of some 350km\textsuperscript{2} around Piltun and Astokh platforms beginning in early June 2015. The 2015 seismic survey will consist of longer survey lines than the 2010 survey, which covered only the Astokh field which was 145km\textsuperscript{2}.

The 2015 survey is predicted to last some 30 days (±10), including uncertainty in timing due to weather, fog, mitigation for whales, and other oil field activities that may be ongoing in the area.

The MMP developed for the 2010 Astokh 4D survey forms the basis for the MMP for the 2015 survey, with modifications based on advances in both knowledge and technology in the intervening years. The mitigation components of the 2015 MMP focus on survey design (e.g. the Company has minimized the survey area and the sound levels expected to reach areas of highest whale density) and on measures to be implemented during the survey. In terms of the latter, as for 2010 the primary mitigating principle remains starting as early as possible in the season and finishing the survey as quickly as possible, such that the survey occurs when fewest whales are present while still ensuring key protective measures.

The present document is an overall outline of the 2015 MMP as developed by the end of NTF-8. For further details, refinements and the rationale for changes from 2010, the reader should consult the full series of SSTF

and NTF reports which are available on the IUCN website\(^2\). The changes relate to aspects of the distributional and behavioural monitoring, the addition of information on the command centre, the refinement of the concept of A- and B-zones, and a change in protection afforded to whales within the behavioural threshold from all whales to only mother-calf pairs (NTF-8, Item 5).

2. MONITORING (NUMBER, DISTRIBUTION, BEHAVIOUR)

The monitoring measures proposed here are *integrally related* to the mitigation measures proposed or likely to be proposed for future surveys. Moreover, most of the monitoring measures are essential for implementation of the mitigation measures for the 2015 seismic survey. The monitoring measures fall into two categories:

1. real-time (or near real-time) monitoring required to trigger appropriate action where sound levels approach or exceed defined thresholds at locations where whales are observed (i.e. *essential* for mitigation);
2. additional monitoring (involving the collection of some data that do not need to be analysed in real time) to obtain data on the effects of the seismic survey on whales, especially gray whales, to add to the existing knowledge base, and to contribute to the design of mitigation strategies for future seismic surveys.

2.1 Shore-Based Command Centre

It is essential for the efficient and successful implementation of the 2015 MMP that the key information from all sources is assembled in one place in near real-time to allow informed management decisions to be taken in a timely manner. A key component of the 2015 MMP is therefore a Command Centre that fulfils this consolidation role.

1. The Command Centre will be established on shore to coordinate implementation of the MMP and to ensure efficient communications among all teams at the various observation platforms and outposts.
2. The Command Centre will be equipped to enable it to receive all real-time data and other appropriate information that is considered essential for overseeing MMP implementation including fact-based decision making.
3. The Company will appoint a qualified MMP Coordinator who will be accorded single-point responsibility for implementation of the MMP. The MMP Coordinator will be able to maintain 24-hour contact with the seismic vessel and all monitoring teams on active duty as part of the MMP.
4. The MMP Coordinator will be based at the shore-based Command Centre.
5. An Independent Observer will be appointed and contracted by IUCN prior to the seismic survey and he or she will be deployed in the field and report on the implementation of the MMP. The Independent Observer will be housed at and will also operate from the Command Centre when not on inspection visits and will be granted full access to information in accordance with the terms of reference (e.g. to observation platforms).

2.2 Acoustic monitoring (perimeter and within area)

2.2.1 Along the perimeter of the feeding area (the perimeter monitoring line, PML)

1. Real-time monitoring of acoustic levels using sea-bottom receivers (automated underwater acoustic recorder (AUAR) stations) deployed on the PML will be undertaken during all periods of seismic source activity.

There will be ten telemetric AUAR stations (some used in line of sight radio mode, others in Iridium satellite mode, others potentially in redundant dual mode) along the PML, with three-station clusters at each end and the remaining four optimally spaced in the intervening length.

Functional integrity of the real-time monitoring infrastructure will be maintained by reactivating any failed node as soon as feasible. Subject to this underlying guideline, the following rules apply (for a definition of A and B lines please see a later section).

(a) If the failed station is a non-clustered one, normal acquisition can continue for a 48 hour period following the failure, after which only ‘safe’ B lines (i.e. any line that is offshore of the boundary between A and B lines identified by the most recent model case plus a 3dB buffer) can be acquired until the failed node is restored.

(b) If the failed station is part of a three-unit cluster, normal acquisition can continue as long as no other station fails anywhere along the PML. If any second station fails, normal acquisition can continue for a 48 hour period following the failure, after which only ‘safe’ B lines can be acquired until both failed nodes are restored.

(c) Any partial A line can be acquired as if the PML was fully operational if the failed node(s) are behind the starting point of the partial line.

Receivers will be in place and verified to be functioning properly before activity starts and for the duration of the survey.

There will be a direct radio link between the real-time acoustic monitoring acoustician outpost, which receives and processes the telemetry from the PML, and the MMP Coordinator.

2.2.2 On the coastal side of the perimeter monitoring line

(1) All necessary efforts will be made to obtain archival acoustic data within the feeding area using bottom-mounted receivers.

(2) During the seismic survey, at least three recording acoustic monitoring buoys will be deployed in the feeding area on or near the 10m isobaths and near the centre of the field of view of the shore stations. Verification that these buoys are operational during the survey should be undertaken, at least at the start of the survey.

2.3 General visual monitoring (shore-based and vessel-based)

Behavioural and distribution monitoring will be conducted in the entire area inshore of the seismic survey area, supplemented by at least occasional observations to the north and south. Monitoring will commence at least one week before the start of the seismic survey and will continue during the survey and for at least one week after its completion. This is important for analysing and interpreting the data with respect to actual or potential effects of seismic surveys on the whales, and for maintaining the longer-term monitoring data series that will be a valuable resource when future seismic operations occur.

2.3.1 On the coastal side of the perimeter monitoring line (shore-based)

(1) Behavioural and distribution monitoring will be conducted from the fixed shore-based platforms located along the area of coastline facing the seismic survey area. The entire potentially affected area shoreward of the PML must be covered. Monitoring will be conducted by four teams, each comprising four visual survey experienced specialists with directly relevant experience. Each team will consist of one a theodolite operator, one computer operator and two observers using reticle binoculars. The distribution of the whales in the areas to the north and to the south of the seismic survey region (see the NTF-8 report) will be monitored occasionally by the photo-ID teams (see (2) below).

(2) Onshore photo-ID efforts will be made opportunistically in order to collect information about individual whales. As the coastal area is divided into two spits by the mouth of Piltun Lagoon, two vehicle-based photo-ID teams will be mobilised who will also carry out the occasional distribution monitoring (see (1) above).
(3) All onshore teams must report to the Command Centre in a timely manner i.e., at least daily but immediately if they have information to report that is of potential relevance to real-time mitigation.

2.3.2 On the coastal side of the perimeter monitoring line (vessel-based)

(1) Gray whale distribution will also be monitored from the seismic vessel. Two Marine Mammal Observers (MMOs) are required for the task of ‘distant’ distribution monitoring (i.e. to detect whales near or shoreward of the PML) in addition to four MMOs who are responsible for monitoring the exclusion zone in close proximity to the seismic vessel. To ensure adequate coverage shoreward of the PML area, a pair of Big-Eye binoculars (one unit) will be mounted on the deck of the seismic vessel for use by MMOs trained in their use. These big-eye binoculars should be mounted such that they have an unobstructed view of the area near or shoreward of the PML whether the survey vessel is sailing in a northward or southward direction.

(2) Vessel-based MMOs must report to the Command Centre in a timely manner i.e. at least daily but immediately if they have information to report that is of potential relevance to real-time mitigation.

(3) Experienced MMOs will be stationed on the seismic vessel for the duration of the survey.

(a) MMOs will be limited to a maximum 2-hour continuous shift with a minimum of 1 hour between shifts.
(b) Single-point authority for operational shutdown related to marine mammal protection will lie with the on-shift Senior MMO on the seismic vessel.
(c) The Command Centre will have direct radio access to the on-shift Senior MMO.
(d) The MMOs will be located on the bridge or at the highest elevation available on the seismic vessel with the maximum viewable range from the bow to 90˚ port/starboard of the vessel.
(e) An extended visual search (20 minutes) will be conducted prior to start-up of the seismic source.
(f) There will be a minimum of two MMOs on watch on the seismic vessel for 20 minutes before start of ramp-up, at any given time during ramp-up, and shooting and throughout line acquisition for the 20 minutes before the start of ramp-up.
(g) Occurrence and behaviour of whales will be documented in accordance with existing Marine Mammal Protection Plan (MMPP) and MMO procedures.

3. MITIGATION MEASURES

3.1 Timing of surveys

(1) The seismic survey will commence and be completed as early in the season as logistically possible. Logistics include ensuring that all mitigation and monitoring procedures are in place.
(2) The duration of the seismic survey will be as short as technically and logistically feasible. Logistics includes ensuring that all mitigation and monitoring procedures are implemented fully.
(3) Lines in Zone A (see definition below) should be acquired at the earliest possible opportunity given visibility, mitigation and monitoring requirements.

3.2 General design and conduct of surveys

The most stringent mitigation measures in relation to whales (other than those observed in the exclusion zone near the seismic vessel) should be applied in the A zone as defined below. The monitoring measures defined above must be in place and operational for the acquisition of lines.

3.2.1 Definition and updating of A and B zones

(1) The area for which the additional mitigation measures are in effect (A zone) is defined by the overlap of the region inshore of the PML and the maximum shoreward extent of the 156 dB per-pulse SEL isopleths for the current acquisition line, bounded by the perpendiculars to said line tangent to the projection on the PML of the 156 dB per-pulse SEL isopleth for the current acquisition point.
Before any lines are shot within the range currently predicted to exceed 156 dB per-pulse SEL at the perimeter monitoring line, received sound levels at the line will be compared with model predictions. If received sound levels differ from model predictions by more than 3 dB, then the model shall be re-tuned to match the observed levels. Based on the updated model predictions, shot lines for which an overlap is predicted between the 156 dB per-pulse SEL contour and the monitoring line will be reclassified as A lines, for which the additional mitigation measures specified below apply.

The comparison between observed and expected sound levels at the PML, and, where indicated, retuning of the acoustic model, shall be repeated at regular intervals during the survey.

In the event that the 156 dB per-pulse SEL threshold is exceeded at any receiver on the edge of the feeding ground while shooting a B line, the line shall be reclassified as an A line immediately.

3.2.2 Measures within the proximity of the seismic vessel – entire survey

(1) After more than 20 minutes of inactive source, ramp-up procedures will be followed such that the individual air guns will be activated in a progressively larger combination over a period of several minutes (6 dB increments every 5 minutes over 20 minutes).

(2) The Senior MMO will initiate source shutdown if a gray whale is observed within the exclusion zone of the source i.e. the circular area that encompasses the region ensonified above 180 dB RMS SPL.

(3) The Senior MMO will initiate a precautionary shutdown if a gray whale is observed to be on a course that is likely to result in its entering the exclusion zone radius.

(4) Various types of remote-sensing equipment will be installed onboard the seismic vessel to try to detect marine mammals during periods of ‘poor visibility’ (e.g. night, fog).

(5) Low level single (smallest) gun operations will be conducted during line changes. Ramp-up procedures will furthermore be implemented 20 minutes prior to the sequential line acquisition.

3.2.3 Additional considerations for Zone A

A considered trade-off is thus required between avoiding the potential disturbance of a smaller number of animals present early in the season against a larger number of whales that present later in the season if operations are still ongoing due to temporary stoppages early in the season. Based on the available information and simulations (NTF-8, Items 3.2 and 5), the following conditions will apply for 2015:

(1) A number of the survey lines (13 lines) positioned closest to shore, sailed from south to north in the 1997/2010 baseline surveys, will be acquired during daylight hours in ‘good visibility’, i.e. the PML must be within the effective sighting distance of a shore station or a distance monitoring team.

(2) No acquisition will occur if mother-calf pairs are observed in Zone A.

---

3 Including technology that blends images from different type of sensors e.g. thermal, low-light and day light,

4 “Poor visibility” means any conditions under which the estimated distance at which a gray whale can be reliably sighted is less than the defined exclusion zone.

5 This is a compromise necessitated by the fact that in 2015 survey lines are extending further north than in 2010, getting closer to Piltun Bay. If a future survey is restricted to Astokh again, the restrictions imposed on the A-zone may be reviewed once more.

<table>
<thead>
<tr>
<th>Recommendation Number</th>
<th>Cross-Reference</th>
<th>WGWAP Recommendation &amp; Requests</th>
<th>Responsible Party/Parties</th>
<th>Target Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>WGWAP-15/001</td>
<td>Item 4.4</td>
<td>The Panel concludes that the matter [of major shifts in whale distribution] should be kept under review, noting that during the 2010 survey, several Panel members made themselves available for consultation during the survey in order to advise on responses to unexpected situations. It recommends that a similar process [of Panel availability] be developed for the planned 2015 survey.</td>
<td>Sakhalin Energy and IUCN</td>
<td>Well in advance of Sakhalin Energy’s seismic survey</td>
</tr>
<tr>
<td>WGWAP-15/002</td>
<td>Item 4.5</td>
<td>As summarised under Item 3 [of WGWAP-15 report], the NTF had made a number of recommendations related to the practical implementation of the MMP given in Annex D of the NTF-8 report. The Panel endorses those recommendations, stressing that (a) their fulfilment is essential to its acceptance of the MMP; and (b) the Company should provide timely confirmation that those recommendations are being addressed. In adopting all of these recommendations and recognizing the importance of progress reports on their implementation, the Panel recommends that the Company submit to the Panel the following information as soon as possible and certainly before 1 February 2015: (1) the proposed protocol for the experiment to assess the efficacy of the ‘blended-vision’ technology; (2) the proposed work schedule for MMOs on board the seismic vessel including primary visual observations, use of Big Eyes and assessment of the ‘blended-vision’ technology; (3) status of the involvement of experienced leadership of the behavioural teams; and (4) progress with identifying a co-ordinator of the command centre.</td>
<td>Sakhalin Energy</td>
<td>1 February 2015</td>
</tr>
<tr>
<td>WGWAP-15/003</td>
<td>Item 4.6</td>
<td>In the absence of good information on the ENL/Rosneft seismic surveys, the Panel recognises that full evaluation of these scenarios is not possible and that it has had to base its advice on the limited information available provided to it by ENL at the WGWAP-14 meeting. The Panel requests that IUCN approach ENL and Rosneft requesting information on their proposed 2015 seismic work, at the same level of</td>
<td>IUCN, ENL and Rosneft</td>
<td>As soon as possible</td>
</tr>
<tr>
<td>Recommendation Number</td>
<td>Cross-Reference</td>
<td>WGWAP Recommendation &amp; Requests</td>
<td>Responsible Party/Parties</td>
<td>Target Completion Date</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------</td>
<td>---------------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>WGWAP-15/006</td>
<td>Item 5</td>
<td>The Panel <strong>recommends</strong> that the MMP be implemented both for the proposed Sakhalin Energy survey and, with appropriate geographical adaptations, for any other seismic surveys to be conducted in the vicinity of (or possibly even in) the feeding area in 2015.</td>
<td>Sakhalin Energy, ENL and Rosneft</td>
<td>Immediately</td>
</tr>
<tr>
<td>WGWAP-15/007</td>
<td>Item 5</td>
<td>Given the lack of information available to the Panel on ENL/Rosneft’s much larger seismic survey programmes, which also approach much closer to the coast and involve larger acoustic footprints requiring strong mitigation measures, the Panel <strong>recommends</strong> that IUCN passes on this [WGWAP-15] report to ENL and Rosneft, stressing in particular (1) that they should undertake similar analyses to evaluate maximum and cumulative exposure levels and (2) the Panel’s previous offer to review ENL’s MMP (and Rosneft’s) to assist in ensuring that they meet the principles outlined in Nowacek <em>et al.</em> (2013) and are in accord with the MMP developed for Sakhalin Energy’s planned seismic survey. The Panel also <strong>recommends</strong> that ENL and Rosneft give serious consideration to postponing part or all of their proposed 2015 programmes, which together appear to be of considerably larger scope and potential impact than the proposed Sakhalin Energy programme.</td>
<td>IUCN, ENL and Rosneft</td>
<td>Immediately</td>
</tr>
<tr>
<td>WGWAP-15/008</td>
<td>Item 5</td>
<td>Inevitably, the Panel has better information on the Sakhalin Energy programme given that company’s extensive co-operation with the Panel and its Noise Task Force. It is understood that Sakhalin Energy intends to conduct a second, smaller and less acoustically intrusive seismic survey in 2016 to acquire OBN data around the platforms [….] Also, as noted above, there are remaining uncertainties with regard to planning for the 2015 streamer survey, including practical details concerning MMP implementation. Under these circumstances, the Panel <strong>recommends</strong> that Sakhalin Energy gives serious consideration to the possibility of postponing its seismic survey until 2016 and combining streamer and OBN technologies as previously anticipated.</td>
<td>Sakhalin Energy</td>
<td>Immediately</td>
</tr>
<tr>
<td>Recommendation Number</td>
<td>Cross-Reference</td>
<td>WGWAP Recommendation &amp; Requests</td>
<td>Responsible Party/Parties</td>
<td>Target Completion Date</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------</td>
<td>---------------------------------</td>
<td>---------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>WGWAP-15/009</td>
<td>Item 5</td>
<td>It is clearly not helpful if both companies postpone their full activities until 2016 as the problems outlined above with respect to the overall ensonification of the whale feeding area will remain. The Panel <strong>strongly recommends</strong> that the companies work together to develop a suitable practical arrangement for 2015 [when multiple concurrent seismic surveys are planned] and 2016 [if postponed] that will result in reduced acoustic disturbance on the feeding/nursery grounds and thus would represent an environmentally responsible way forward.</td>
<td>Sakhalin Energy, ENL, Rosneft</td>
<td>As soon as possible</td>
</tr>
</tbody>
</table>

For the responses (and any updates) from responsible parties and the current implementation status, please the WGWAP Recommendations Database: [https://www.iucn.org/western-gray-whale-advisory-panel/recommendations](https://www.iucn.org/western-gray-whale-advisory-panel/recommendations)