REPORT OF THE WESTERN GRAY WHALE ADVISORY PANEL
AT ITS 15TH MEETING

CONVENED BY THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE
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**ABBREVIATIONS**

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<tr>
<td>AASM</td>
<td>Airgun Array Source Model</td>
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<td>AUAR</td>
<td>Automated Underwater Acoustic Recorder</td>
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<td>Company</td>
<td>Sakhalin Energy Investment Company</td>
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<td>dB</td>
<td>Decibel</td>
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<td>DMNG</td>
<td>DalmorNeftegeophysica</td>
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<td>ENL</td>
<td>Exxon Neftegas Limited</td>
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<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
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<td>MC</td>
<td>Mother-Calf</td>
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<td>MMO</td>
<td>Marine Mammal Observer</td>
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<td>MMP</td>
<td>Monitoring and Mitigation Plan</td>
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<td>NTF</td>
<td>Noise Task Force</td>
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<td>OBN</td>
<td>Ocean Bottom Node</td>
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<td>Photo-ID</td>
<td>Photo Identification</td>
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<td>PML</td>
<td>Perimeter Monitoring Line</td>
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<td>SEER</td>
<td>State Environmental Expert Review</td>
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<td>SEIC</td>
<td>Sakhalin Energy Investment Company</td>
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<td>SEL</td>
<td>Sound Exposure Level</td>
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<td>WGWAP</td>
<td>Western Gray Whale Advisory Panel</td>
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1 INTRODUCTORY ITEMS

1.1 General
The 15th meeting of the Western Gray Whale Advisory Panel (WGWAP-15) was held by teleconference on 8-9 December 2014. This was the first attempt to conduct a formal Panel meeting in such a manner and was made necessary by the fact that the last two meetings of the Noise Task Force (NTF) had taken place after the most recent Panel meeting – WGWAP-14 in Yuzhno-Sakhalinsk, Russian Federation, 29 September – 1 October 2014.1 NTF-7 took place in Yuzhno-Sakhalinsk, 3-5 October 2014, and NTF-8 in Washington, D.C., USA, 17-18 November 2014. According to the WGWAP Terms of Reference, task forces are formed by and report to the Panel. Therefore, it was necessary for the Panel to receive the findings of NTF-7 and NTF-8 before reaching any conclusions concerning plans for seismic surveys in 2015.

Sakhalin Energy had indicated that it required advice from the Panel on the Monitoring and Mitigation Plan (MMP) for its proposed 2015 seismic survey by mid-December 2014. It proved infeasible for a variety of reasons for the Panel to meet face-to-face and produce its ‘final’ advice on this topic while at the same time meeting the deadline set by the Company. Therefore, the following arrangements were agreed at WGWAP-14 to accommodate Sakhalin Energy’s requirements:

1. The NTF-7 report is completed as quickly as possible after the meeting;
2. The NTF-8 report is completed no later than 24 November 2014;
3. Both NTF reports are circulated by the International Union for Conservation of Nature (IUCN) directly to Panel members, Sakhalin Energy and Observers, with a request for written comments from Observers by 1 December 2014;
4. The Observer comments are received and collated by IUCN and circulated directly to the Panel by 3 December 2014;
5. The Panel meets by teleconference and sends its final advice to the Company through IUCN no later than 12 December 2014;
6. The WGWAP-15 report is posted on the WGWAP website once the Panel has determined it to be final.

The above procedure was followed and all deadlines were met. The draft Panel report was delivered to IUCN on 12 December. IUCN sent the report to Sakhalin Energy for the usual ‘fact-check’ by the Company, and the final report was submitted to IUCN on 15 December 2014.

The teleconferences on 8 and 9 December were organized by IUCN and chaired by R.R. Reeves. The lists of participants are given in Annex 1. Three Panel members were unable to join the meeting due to competing commitments – Brian Dicks, Robert Brownell and Grigory Tsidulko. All were invited to participate in the e-mail discussions within the Panel before, during and after the teleconferences and to approve of the draft and final report.

The Panel gives special thanks to Anete Berzina of IUCN who organized and supported this meeting (and the NTF meetings leading up to it) with admirable efficiency and dedication. Her contributions included acting (informally) as a note-taker (rapporteur). In addition, the Panel appreciates the always cheerful and patient work of Alexander Danilov who provided Russian-English translation in ‘real time’ during the teleconferences.

1 http://iucn.org/wgwap/wgwap/meetings/wgwap_14/
Reeves emphasized at the outset that the sole focus of this meeting would be seismic surveys planned for 2015 by Sakhalin Energy and Exxon Neftegas Limited (ENL). He noted that other activities planned to take place in the 2015 open-water season, and in particular any activities that might be expected to cause disturbance to gray whales in the feeding areas off Sakhalin, would be considered briefly as well. He also noted, however, that the report of WGWAP-14 had been finalized and released only days before WGWAP-15 and that report considers such other activities (e.g. ENL pier construction, salmon fishing, tourist cruise ship visits, satellite tagging) in some detail. No relevant new information on other activities has been received since WGWAP-14.

1.2 Adoption of agenda
The draft agenda was adopted on the understanding that it would serve the purpose even though it was not as detailed as the usual WGWAP agenda. The agenda is given as Annex 2.

2 AVAILABLE DOCUMENTS/MATERIALS
The list of documents is given in Annex 3. It includes the NTF-7 and NTF-8 reports and the WGWAP-14 report, several documents prepared specifically for this meeting, and the comments and questions received from Observers prior to the meeting. It also includes the responses from Sakhalin Energy to the Observer input directed to the Company, as well as the Company’s response to Panel requests for clarification arising during the WGWAP-15 teleconference.

3 SUMMARY OF KEY FINDINGS AND ITEMS STILL PENDING FROM NTF-8
3.1 NTF Chairman’s summary
Donovan briefly summarised the main work of the NTF at its 8th meeting (NTF-8), 17-18 November 2014. Given the severe time constraints for the Panel to be able to advise the Company by mid-December 2014 as required, the meeting focussed only on the Company’s 2015 monitoring and mitigation programme (MMP). The NTF-8 report was made available on the IUCN website on 24 November 2014.

3.1.1 Final survey logistics
Item 2.1 of the NTF-8 report summarises details of the streamer seismic survey that had been finalised by the Company although a public announcement had not been made at the time of the meeting. The scope of work for the 4D streamer survey remained unchanged: Piltun-Astokh 4D covering 350 km² and Lunskoye covering 290 km². However, the Ocean Bottom Node (OBN) component (i.e. acquisition of baseline data for this new technology, which was meant to be carried out during the 2015 streamer survey) would not be undertaken for logistical and financial reasons in 2015 and plans to carry out this work in 2016 were being considered. With respect to the issue of ‘time-sharing’ with the proposed 2015 ENL surveys discussed at WGWAP-14, Sakhalin Energy indicated that it was essential for an agreement to be reached if the two companies’ surveys were to go ahead in 2015.

The previous meetings of the NTF on Sakhalin Energy’s 2015 survey had assumed a source volume of the same or less than the 2010 survey (2,620 in³). However, the new tender involved a source volume

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2 As explained under Item 4.2 and in Appendix 1, ‘ENL surveys’ should be understood to encompass, at least in some instances, a multifaceted seismic survey programme to be carried out by Dalmor neftegeophysica (DMNG) on behalf of both ENL and Rosneft.


4 All NTF reports can be found at https://www.iucn.org/wgwap/wgwap/task_forces/noise_task_force/
of 3,255 in$^3$. Despite this, the Company produced output from the industry standard programme 
*Nucleus* that modelled the vertical signatures of airgun array output to be substantially less than the 
2010 survey. There was considerable discussion of this result and the results of the acoustic modelling 
provided by Racca (see NTF-8, Item 3.1). Given the assumptions behind Racca’s modelling, the NTF 
agreed that the modelling work to determine the expected footprints from the new seismic source 
would proceed. It also noted that *in situ* measurements to verify sound source characteristics must be 
compared to model predictions based on the expected footprints with similar rules to those in 2010 for 
modifying operational procedures if sufficient variance from predicted values is observed.

3.1.2 Simulation modelling

Simulating various scenarios to compare the implications of different survey strategies and mitigation 
approaches has been a key component of the NTF work since its sixth meeting. Considerable work 
had been undertaken since then and final results of what is termed the ‘spreadsheet’ approach were 
reviewed at NTF-8 (see NTF-8 report, Item 3.2). Details of that study are not repeated here but the 
broad conclusions of this aspect of the simulation work are summarised below.

One important component of the discussions concerned the timing of the whales’ arrival to the area, 
the speed at which their numbers increase and when their numbers reach a peak or plateau in the 
region. After considerable discussion, the NTF agreed that the base case scenario was that whales 
reached a plateau by 1 August (based upon consideration of all available data combined) but that a 
sensitivity test should be run assuming an ‘early plateau’ (15 June) as was suggested by a simple 
examination of the 2010 data. The analyses are confounded by difficulties related to varying start dates 
and effort correction issues and the NTF agreed that this *reconfirms* the importance of collecting good 
information on whale distribution and abundance early in the season, given that completing a seismic 
survey as early as possible when fewer whales are expected to be present is considered a key 
component of the mitigation strategy. If whale numbers did not ramp up from early June to mid or late 
July, then it could be argued that (a) starting the survey as early as possible is unnecessary and (b) the 
trade-off between allowing a few whales to be affected early in the season in exchange for ensuring 
that many whales are unaffected later in the season does not apply, thus putting the emphasis on the 
protection of individual whales.

The simulation results (NTF-8, Table 1) led to the following assessments:

1. the advice to start as early as possible is shown to be the most important mitigation measure 
   (with the obvious exception of the scenario in which all animals have already arrived by 15 
   June, the earliest start date contemplated);
2. for the predicted number of hits (whale exposures) at per-pulse levels above 156 dB re 1µPa$^2$-s 
   per-pulse sound exposure level (SEL), there is relatively little difference by mitigation strategy 
   for early and mid-season starts;
3. for the days to complete the Sakhalin Energy survey alone (i.e. no ENL survey) scenario, the 
   case with no mitigation measures is always the shortest, taking some 16-17 days increasing to 
   around 24 days for the mitigation options for the early start, around 35 for the medium start 
   and 45-51 for the late start;
4. for the time-sharing options and survey completion, the no mitigation option increases to 
   around 22 days while the mitigation options take some 30 days for the early start and some 45 
   days for the medium start;
5. for time sharing versus One Company scenario, the predicted number of hits at per-pulse 
   levels above 156 dB SEL is similar.

However, the NTF agreed that these conclusions needed to be considered in the light of the cumulative 
exposure work, the objective of which was to provide more quantitative information on the trade-off 
between protecting individuals versus the broader population.
The cumulative exposure work, which was carried out by Cooke using source level and propagation estimates provided by JASCO for the Sakhalin Energy survey, was considerably more complex and required developmental work and new programme coding. The NTF received preliminary results (see NTF-8 report, Item 3.2.2) and made a number of improvements and requested that additional results be made available to the Panel and the Company by 26 November 2014 (see Item 4.2, below).

3.1.3 Behavioural criteria for shutdown
A literature review had revealed no significant new information on aberrant behaviour criteria since 2010, thus providing no justification for any changes to the 2015 MMP relative to the 2010 MMP in this regard. Much of the focus of NTF-8 discussion was related to mother-calf pairs (NTF-8 report, Item 3.3.2). In conclusion, the NTF had agreed that sightings of one or more mother-calf pairs within the zone of exposure to sound levels of 156 dB per-pulse SEL or higher must always trigger a shutdown; this mitigation measure must be adhered to strictly and consistently even if this means that seismic acquisition is incomplete as a result. The Company accepted this condition and noted that it would seek to complete whatever portions of ‘interrupted lines’ prove feasible without risk of exposing mother-calf pairs to unacceptable levels of seismic noise.

3.1.4 Mitigation and monitoring plan (MMP) for 2015
The main discussions on this subject focussed upon work begun at NTF-7. The NTF had agreed that the rationale for any proposed changes to the 2010 MMP must be fully documented. Given the scale of the planned 2015 survey, it is likely that any effects, should they occur, will be more detectable than in 2010, even if the survey is completed quickly (see NTF-7 report, Item 7).

The NTF-8 report highlights the discussions and agreements reached with respect to:

- the ‘modified’ A- and B-line concept (NTF-8 report, Item 4.2);
- real-time and archival acoustic monitoring and mitigation (NTF-8 report, Item 4.3);
- the need for both behavioural and distribution monitoring and how it should be achieved (NTF-8 report, Items 4.4 and 4.5);
- the fact that the 13 lines closest to shore (i.e. those which appear to be most problematic in terms of ensonifying the feeding area above the ‘behavioural threshold’ level) would only be shot in good visibility conditions.

The NTF made a series of recommendations that require the Company to provide updated information on progress – the successful implementation of these is key to the MMP working effectively as it should (see NTF-8 report, Items 4 and 5(1)). These relate to:

1. development of a robust communications system amongst all teams and the command centre – the MMP will not function properly without a reliable communications and reporting system;
2. deployment of 10 telemetric Automated Underwater Acoustic Recorder (AUAR) stations as described in the NTF-8 report (Item 4.3.2) and the associated rules on how to handle any failures;
3. use of Big-Eye binoculars on the seismic vessel and Marine Mammal Observers (MMOs) who are trained in their use;
4. development by the Company of a protocol for evaluating the effectiveness of ‘blended-vision’ technology by comparing the results of observations by visual MMOs with the results obtained from the ‘blended-vision’ technology during periods of good visibility (the Panel acknowledges that for the Company’s proposed 2015 survey, this issue may be of less importance if the 13 lines closest to shore are surveyed in daylight, but the evaluation of effectiveness is important for decisions on future deployment of this technology);
(5) having an adequate number of trained MMOs with experience observing gray whales on board the seismic vessel to undertake all necessary duties with sufficient rest periods to ensure their effectiveness;

(6) all shore- and vessel-based observers being able to determine whale positions with sufficient precision and communicate them in a timely fashion to the command centre;

(7) acceptability of the MMP with respect to monitoring is dependent upon experienced, well-trained, well-equipped and well-prepared personnel who are deployed on time – the Company has not yet demonstrated that this has been achieved;

(8) the mobile photo-ID teams undertaking distribution scans north and south of the direct seismic area – these need to continue even if no animals are sighted as positive information concerning the absence of animals is valuable;

(9) making available any relevant analyses undertaken using SEIC/ENL Joint Programme data (i.e. outside the geographical or temporal zone of the Sakhalin Energy seismic survey) to the Panel for comment.

3.1.5 Text for the MMP for 2015

After the discussions during NTF-8 and on the assumption that the recommendations above are met, the NTF worked with the Company to develop text for the 2015 MMP (NTF-8 report, Annex D). The Sakhalin Energy MMP as given in Annex D of the NTF-8 report represents the task force’s best efforts with the information to hand, to incorporate: (1) a mitigation approach that represents a reasonable trade-off between protection of individuals versus overall exposure of the population; and (2) a suitable monitoring programme to evaluate the effectiveness of the measures and improve the knowledge base for future seismic surveys.

The determination of this balance was considerably more difficult for the 2015 survey given its much greater scope than the 2010 survey (even when focussing on the Sakhalin Energy survey alone, irrespective of concerns over the other 2015 activities). A primary difficulty in the discussions was the change from the 2010 requirement that a shutdown is ordered when any whales, and not just mother-calf pairs, are seen within the behavioural threshold exposure zone, to the 2015 proposal that this requirement would apply only to mother-calf pairs. This is directly related to the question of a trade-off between the primary mitigation measure to start and complete the survey as soon as possible and the agreed 2010 protocol which accorded protection to all animals within the agreed ‘behavioural threshold’ limits of exposure (156 dB per-pulse SEL).

Some members of the NTF reserved the right to maintain their support at the upcoming Panel meeting for a conclusion that all animals within the feeding area should be protected from exposure above the agreed ‘behavioural threshold’, including taking into account any results that may arise from the cumulative exposure modelling exercise (Item 4.2, below). In any event, it was agreed that any relaxation of the behavioural threshold protection for all animals in the 2015 survey should not be seen as a precedent and that it should be reviewed again in the light of results obtained in 2015 and further consideration of modelling approaches examining cumulative exposure discussed under Item 3.2 in the NTF-8 report.

3.1.6 Independent observer

Following on from NTF-7, the NTF agreed that an independent observer is a potentially valuable element of the overall MMP and that IUCN should proceed to facilitate the identification and contracting of a suitable individual, working in close collaboration with the chairmen of the Panel and NTF and in coordination and consultation with the Company.

3.1.7 NTF Chairman’s concluding remarks

In concluding his summary for the Panel, Donovan noted that all members of the NTF had worked extremely hard in a very short timeframe to address a set of difficult and challenging issues. Whilst
great progress had been made, in his view six important items needed further consideration by the Panel:

(1) questions raised initially during the NTF-8 discussions, which Donovan and some other Panel members understood to have been answered (and thus are not referred to in the NTF-8 report) but were subsequently raised during the Panel’s internal discussions, concerning acoustic modelling for the final power source and configuration for the 2015 survey and whether the footprints might be underestimated;

(2) the results of the cumulative modelling exercise agreed to be undertaken after NTF-8 and prior to the Panel meeting which are critical to trying to better quantify the effects of the ‘trade-off’;

(3) evaluation of the concerns over relaxation of the behavioural threshold rule from all animals to mother-calf pairs only, especially in light of the modelling results mentioned under (2);

(4) ensuring that the recommendations for post-NTF work (summarised above), which are essential for effective implementation of the proposed MMP, are followed;

(5) what action would be appropriate if whales are present shoreward of the seismic survey area at the start of the survey but move away during the survey, with the possibility that they are being kept away from their primary habitat for an extended period (there had been insufficient time to properly address this);

(6) incorporating the information from the NTF-8 meeting into the wider context of all activities expected to take place off Sakhalin in 2015 – this had been beyond the remit of NTF-8.

3.2 Panel discussion
The Panel thanked the NTF for its extremely hard work and commitment in trying to provide advice in a short timeframe. However, the Panel felt considerable frustration at being forced to work in such a compressed timeframe for planning the MMP for what is a Sakhalin Energy survey of much larger scope and scale than the 2010 Astokh 4D survey, and in a context where an even larger survey programme by another company is being planned to co-occur with essentially unknown monitoring and mitigation protocols in place. Despite this, the Panel endorses the recommendations in the NTF-8 report, recognising the six specific outstanding issues that require further discussion. These are considered under separate agenda items below.

4 DISCUSSION OF ITEMS ARISING OUT OF NTF-8

4.1 Acoustic modelling for the 2015 survey
As noted above, the NTF-8 meeting was the first time the task force had received information on the final seismic equipment, although prior to that it had been working on the assumption that the 2010 survey equipment was a suitable proxy. During the NTF-8 meeting there was some discussion about the acoustic modelling for the final power source and configuration for the 2015 survey. In that discussion it was judged that the proxy assumption was not unreasonable and that the final configuration was actually slightly lower in power than in 2010 despite being a larger source. Some discussion ensued at the NTF meeting about whether the footprints might be underestimated but at that time it was thought to have been resolved, as shown in the NTF-8 report. However, after the NTF-8 meeting, concerns were again raised within the Panel. A major reason for this additional debate is that there was simply not enough time for proper review during NTF-8. It was also not possible to discuss this matter further within the NTF given the short period between the NTF-8 meeting and the WGWAP-15 teleconference.

The sound propagation modelling used to predict source characteristics for the 2015 survey was conducted in a similar fashion to that in 2010, a process which resulted in measured sound levels within a very reasonable margin of error (±3 dB) relative to modelled ones. For the sound contour maps as well as for the cumulative exposure model, planar contours of SEL pulse levels – maximized
over depth – were generated through full Parabolic Equation propagation modelling of the directional source levels generated by the Airgun Array Source Model (AASM). These results were for the full 10 Hz to 2 kHz frequency range, with no low-pass filtering. From the estimated received level at various ranges and angular bearings from the array tow direction, an approximate set of directional levels were derived assuming a simplified propagation law of 17*log(radius), a formula derived from previous modelling and in situ measurements. The generalized range-direction dependent approximations were then derived from these source levels, and a cosine series used to interpolate between the cardinal points supplied.

After much deliberation, the Panel concluded that the supplied data were sufficient for its needs in attempting to evaluate potential effects in advance of the survey. The Company will have to rely on the operational safeguards recommended for the 2010 and planned 2015 survey, which must include the Seismic Source Verification procedure prior to the start of seismic acquisition in order to make any necessary corrections to model predictions. If the measurements made in the field indicate that the predictions of received levels are incorrect, then the operational contingencies and mechanisms in place must be used to recalibrate the acoustic modelling, with the implications that carries for mitigation.

4.2 Maximum and cumulative sound exposure modelling

As recommended by the NTF, the analyses reported in Appendix 1 were conducted by the Panel, based on source level and propagation estimates provided by the Company, with a view to estimating the expected maximum and cumulative levels of sound exposure experienced by gray whales under various scenarios. Rough estimates of the 2010 Astokh survey were also obtained for comparative purposes, and the surveys planned by ENL and Rosneft (to be carried out by Sakhalin geophysical company Dalmorneftegeophysica, DMNG; see below and Appendix1) for 2015, on the assumption of a similar noise source to that planned for the 2015 Sakhalin Energy survey.

The two technical mitigation measures considered in the analyses are: (i) shutdown whenever a gray whale is seen within 2 km of the source (‘injury shutdown’); and (ii) shutdown when whales (alternatively: just mother-calf pairs) are seen within the designated feeding area in a position subject to predicted ensonification exceeding 156 dB per-pulse SEL (‘behavioural shutdown’). Strengthening or relaxation of these measures is examined in alternative scenarios.

4.2.1 Predictions of exposure for the proposed Sakhalin Energy survey

The results show that whales are likely to be exposed to higher levels of sound in the proposed 2015 Sakhalin Energy survey than in the 2010 Astokh survey, but that if the sound source strength for 2015 could be reduced by 50% (3 dB), then sound exposures would be less than those estimated for the 2010 survey.

Restricting the behavioral shutdown rule to mother-calf pairs is not predicted to increase the overall sound exposure of whales, but will increase the likelihood that all survey lines will be successfully acquired. The reason that relaxation of the shutdown rule does not increase overall exposures is that it enables the survey to be completed sooner, before the peak occurrence of whales.

Assuming the 13 inshore lines which potentially ensonify a substantial portion of the feeding ground to >156 Db SEL are surveyed by day, use of night-vision technology, even if it proves to be less effective for the detection of whales, is not predicted to have a significant effect on exposures. The reason is that few whales enter the 2 km shutdown radius anyway, typically only 2-3 per survey, such that the injury shutdown rule is rarely activated even with perfect detection.

If whales arrive in the area earlier than expected, as suggested in the 2010 shore-based sighting results, then the predicted average sound exposures from the survey would be greater.
4.2.2 Provisional predictions of exposure for the DMNG (ENL and Rosneft) and combined surveys

As reported at WGWAP-14 and NTF-7, DMNG appears to be planning to conduct seismic surveys in the Odoptu-More, Chayvo and Arkutun-Dagi blocks for ENL, and in the North Chayvo block for Rosneft. On the assumption that the entire area of these blocks would be surveyed with the same intensity and with a similar sound source as the Sakhalin Energy survey, the DMNG surveys are predicted to result in considerably higher acoustic exposures. If the DMNG surveys take place, exposure to those surveys is predicted to dominate the total exposure, such that the combined exposure from the DMNG (for ENL and Rosneft) and Sakhalin Energy surveys is not predicted to be noticeably more than from the DMNG surveys alone. However, as discussed under Item 4.4, the simultaneous conduct of the DMNG and Sakhalin Energy surveys could result in a greater impact on the whales, because of spatial effects (lack of a quieter part of the feeding ground to which to escape).

The predictions for the DMNG surveys assume the same injury shutdown radius of 2 km as used for the Sakhalin Energy survey. However, in the case of the ENL surveys, the injury shutdown rule alone results in non-completion of some nearshore lines in the Odoptu-More block. If the behavioral shutdown rule is also implemented (shutdown when whales within the feeding ground are exposed to >156 dB per-pulse SEL) then more of the nearshore lines fail to be successfully acquired. In the absence of a behavioral shutdown rule, exposures are predicted to become extremely high (see Appendix 1, Figures 5 and 6) and to reach levels that, based on current knowledge, should be avoided.

The Panel notes the limited information on which these analyses of the proposed DMNG surveys are based, and strongly urges ENL and Rosneft to conduct a more detailed analysis of the type reported in Appendix 1, using the actual source characteristics and grid of lines to be acquired, before going ahead with their surveys. Any defensible mitigation rules are likely to result in non-acquisition of the most nearshore lines of the Odoptu-More and North Chayvo blocks unless a source of considerably lower volume is used than that assumed here. In this case, ENL and Rosneft are encouraged to seek alternative methods for surveying the nearshore lines in the event that the data from these lines are found to be essential for the planning of future extraction operations.

4.3 Consideration of relaxing the rules with respect to behavioural threshold exposure

As noted above, this was the subject of considerable debate within the NTF, with some members questioning whether the proposed trade-off between protection of individual whales and protection of the population as a whole was appropriate, given the standards agreed in 2010. The NTF discussions were inconclusive in that some members reserved the right to comment further when the results of Cooke’s modelling of maximum and cumulative exposures became available (see Item 4.2 above).

The results from that work show that, under the assumptions made (see recommendations below), the overall cumulative exposure is considerably lower if the shut-down requirement is relaxed and applies only to mother-calf pairs (see Item 4.2, above). This primarily relates to the fact that the survey is completed sooner. The results for the proportion of animals that receive a maximum exposure of 156 dB per-pulse SEL is also lower, but only slightly lower, if the shut-down requirement is relaxed.

The Panel is concerned that relaxation of the rule for 2015 may be seen as stepping back from its agreed protective principles developed for the 2010 survey. However, it notes that the primary mitigation measure agreed for that survey was that the survey was completed as early and as quickly as possible to reduce the number of individuals potentially affected. In order to achieve that, different mitigation measures were adopted for A- and B-lines with respect to individuals, which was, in effect, a trade-off between individuals versus the population as a whole.

For the present survey, the NTF developed two simulation approaches (the spreadsheet and the ‘Cooke’ approaches) to address quantitatively the question of an appropriate trade-off. This represents a methodological advance on the approach used for the 2010 survey. The results of both approaches,
under the assumptions made, confirmed that if the survey is to go ahead, then the numbers of whales that will be exposed to sound levels above the behavioural threshold will be lower if the shut-down rule is relaxed to apply only to mother-calf pairs; the difference is substantial with respect to cumulative exposure although only slight with respect to maximum single-pulse exposure. This general rule is applicable even if the acoustic modelling underestimates the actual footprints of the proposed survey.

Because the mitigation benefits of relaxing the behavioural shutdown rule only apply to acquisitions prior to the period of peak whale abundance, the Panel considers that the relaxation should apply only to lines acquired prior to 15 July (the date by which whale abundance in the feeding area is predicted to have reached 75% of its peak level).

The Panel once again stresses that relaxation of the behavioural threshold protection for all animals in the proposed 2015 MMP should not be seen as a precedent and that it should be reviewed again in the light of results obtained in 2015 and any additional modelling work. As noted under Item 4.4, it also noted that mother-calf pairs are less able than adults to change their distribution in response to disturbance.

In agreement with the NTF, the Panel also stresses that sightings of one or more mother-calf pairs within the zone of exposure to sound levels of 156 dB per-pulse SEL or higher must always trigger a shutdown; this mitigation measure must be adhered to strictly and consistently even if this means that seismic acquisition is incomplete as a result. The Panel noted that the Company has accepted this condition.

4.4 Displacement from important habitat

As noted above (Item 3), there was insufficient time to address this issue at NTF-8 and so the Panel examined the available evidence from previous seismic operations off Sakhalin.

In 2001, ENL conducted a 3-D seismic survey of the Odoptu license area from 17 August to 9 September (Johnson et al. 2007). The inshore perimeter of the license area overlapped directly with the offshore perimeter of the Piltun feeding area. A MMP was established to minimize impacts of the seismic survey on gray whales (see Special Section of Environmental Monitoring and Assessment, Volume 134, Numbers 1-3, November 2007).

Two studies that examined data collected during the 2001 survey found that whales shifted their distribution tens of kilometers to the south, away from the northern region where the seismic survey was being conducted (Weller et al. 2006, Yazvenko et al. 2007a). Because gray whales congregate off north-eastern Sakhalin Island during summer and autumn to feed, it is possible that displacement by the seismic survey operations forced them to forage in suboptimal locations, thereby compromising nutrition, health, calf survival and in the case of adult females, reproductive potential. Industry-sponsored aerial surveys during the 2001 seismic programme led Yazvenko et al. (2007b) to conclude, based on an ‘overall feeding index’ derived from a ratio of pods associated with mud plumes to all observed pods, that gray whale feeding activity was not significantly affected by seismic operations. This interpretation has been questioned, however, because foraging success and prey type were not evaluated. That is to say, foraging activity (in this case as determined by the presence of mud plumes) is not necessarily indicative of successful prey consumption (as acknowledged by Yazvenko et al. 2007b, p. 101), prey quality or caloric uptake (Weller et al. 2006).

Following the June/July 2010 Astokh 4D seismic survey (commissioned by Sakhalin Energy), Vladimirov et al. (2011) reported that a comparison between the August-September 2010 distribution data and the August-September 2009 SEIC/ENL Joint Programme data indicated a generally northward shift in the concentration of whales in 2010, accompanied by a decline in the presence of
whales in the southern periphery of the area covered by the distribution surveys. Although the authors attributed this change to shifts in prey distribution, it would also be consistent with avoidance of the seismic survey area, which was close to the southern part of the area.

In summary, the evidence that previous seismic surveys were the cause of major distributional changes in gray whale distribution off Sakhalin, whilst suggestive, is not conclusive. Disruption of feeding in demonstrably and historically important feeding habitat is a biologically significant event that could affect the health of individual whales, their reproductive success, and the population as a whole in ways that crude assessments of overall foraging patterns would be unable to detect. In both 2001 and 2010, whales apparently were able to shift their distribution to different portions of the feeding area. In 2015, the situation is expected to be quite different. The operation of two concurrent sets of seismic surveys (one for Sakhalin Energy and the other by DMNG for ENL and Rosneft) in proximity to all or most of the near-shore feeding area, possibly in combination with activities related to the construction of the ENL pier, salmon fishing and other potential sources of disturbance (see report of WGWAP-14), would mean that little (if any) of the near-shore gray whale feeding habitat will be undisturbed during the season up to at least the middle of July and perhaps further beyond that.

Under such circumstances, it is possible that the type of relatively small-scale displacement of animals as observed in 2001 will be replaced in 2015 by abandonment of the entire feeding area. Off Piltun, the near-shore feeding area is especially important to reproductive females and their calves because these pairs do not use the Offshore feeding area. Therefore, the potential effects of displacement or habitat abandonment in 2015 are of particular concern at both the individual and population level.

The Panel recognises that there are insufficient data for making reliable predictions as to what may happen in 2015 but believes that a precautionary approach is warranted. This reinforces the value of the distributional monitoring component of the MMP (see above). This is true throughout the feeding areas, not only for Sakhalin Energy but also for ENL, Rosneft and the SEIC/ENL Joint Programme. The Panel concludes that the matter 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 be developed for the planned 2015 survey.

4.5 Ensuring that practical arrangements for implementing the MMP are satisfactory

As summarised under Item 3, 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

Abandonment (and subsequent reoccupation) of important breeding/nursery habitat due to anthropogenic disturbance has been reported for gray whales in a wintering lagoon in Baja California, Mexico (Gard, 1974). In that case, the whales stopped using Guerrero Negro Lagoon during a period of intensified dredging and commercial shipping but reoccupied the lagoon in later years after these activities had subsided (Gard 1974; Bryant et al. 1984).

5 Abandonment (and subsequent reoccupation) of important breeding/nursery habitat due to anthropogenic disturbance has been reported for gray whales in a wintering lagoon in Baja California, Mexico (Gard, 1974). In that case, the whales stopped using Guerrero Negro Lagoon during a period of intensified dredging and commercial shipping but reoccupied the lagoon in later years after these activities had subsided (Gard 1974; Bryant et al. 1984).
progress with identifying a co-ordinator of the command centre.

4.6 Consideration of the proposed Sakhalin Energy streamer survey in the context of the overall activities to be undertaken in 2015, 2016 and beyond

The Panel has already stated its serious concerns about the overall level of seismic and other activities projected to occur in the vicinity of the feeding/nursery grounds of gray whales off Sakhalin in 2015, particularly the Sakhalin Energy and ENL/Rosneft seismic surveys, and the possibility that this will adversely affect the whale population (see WGWAP-14 report, Item 5.5).

The Panel noted that analyses completed up to NTF-8 and since then show that under the assumptions made (and considering the limited information available for non-Sakhalin Energy activities), the levels of ensonification of the feeding area in 2015, even by the Sakhalin Energy survey alone, will substantially exceed those in 2010 (not surprising given that the 2015 survey will cover some 2.5 times more area and will occur closer to shore in some places). It is clear that if both the Sakhalin Energy and DMNG (for ENL and Rosneft) seismic survey programmes go ahead, ensonification levels will be considerably higher and more whales will be affected as the period of seismic surveying will be more prolonged (see 4.2, above). As discussed under Item 4.2, the simultaneous occurrence of the two survey programmes would result in nearly continuous exposure of the feeding area to seismic noise (levels obviously varying depending on which lines are being shot) for 30 days or more. Time-sharing arrangements, despite some advantages as well as operational necessity, will increase the overall time required to complete both sets of surveys (e.g. adding a minimum of 5 days to the Sakhalin Energy survey, depending upon scenarios tested – see NTF-8, p.8). The whales on the feeding ground will be exposed to substantially higher doses of both maximum and cumulative sound than was the case in 2010 if both sets of surveys proceed in the same season; by far the dominant component of this work is that proposed by ENL/Rosneft (again, see Item 4.2).

The Panel reiterates its statement from the WGWAP-14 report that in planning for its 2015 seismic survey, “Sakhalin Energy has, to its credit, pursued a transparent process involving extensive discussions with the Panel’s Noise Task Force to develop the MMP as well as submission of its plans to a State Environmental Expert Review (SEER). This is in contrast to other operators who have chosen, for example, not to submit their plans to a SEER and instead are relying on the seismic vessel’s general permit to operate.”

The Panel stresses that there is need for a full evaluation of the ENL/Rosneft programme in a manner similar to what has been applied to the Sakhalin Energy programme if the potential effects on gray whales are to be properly evaluated and an appropriate overall mitigation and monitoring strategy is to be developed. In this context, we note that although this matter may be considered to be outside the Panel’s scientific remit, we recognise that our sometimes critical comments and review of Sakhalin Energy’s proposal may appear unfair – that is, it may appear as though we are being more critical of a company that follows a more transparent approach than we are of other companies that do not. Nevertheless, from a precautionary perspective, it is clear that the projected noise levels for seismic activities in 2015 are way beyond those of previous years and that one obvious way to limit the potentially adverse effects would be to limit the survey effort. This is considered further in the recommendations below.

For several years, the Panel has stressed the importance of the oil and gas industry finding new ways to obtain the data now obtained solely from seismic surveys such as those planned for 2015. Initially, the Panel had welcomed the news that Sakhalin Energy planned to use Ocean Bottom Node (OBN) technology (described in the NTF-5 report as ‘ocean bottom seismometers’), with smaller airgun sources (resulting in less ensonification), in tandem with its streamer survey in 2015. It was anticipated that the data acquired from the OBN component would constitute a baseline data set,
which could then be used for reservoir monitoring in subsequent years and thus eliminate the need for further streamer airgun surveys.

However, the Company confirmed that the OBN technology will not be deployed during the 2015 survey for logistical and/or cost reasons and that instead the baseline OBN survey may be conducted in 2016. Subsequent to the NTF-8 meeting, the Company noted that its proposed OBN work for 2016 would be of considerably smaller extent than the 2015 streamer survey and limited to areas around the platforms; the sound source had not been finalised but was expected to be considerably lower volume than the source for the streamer survey. The Panel noted that a full examination of the proposed activities and possible strategies for 2015 and 2016 would use ‘good’ information on both companies’ activities to consider the following scenarios:

1. **2015**: Sakhalin Energy alone (this evaluation has been completed although as discussed above, some doubts remain concerning the acoustic source and propagation modelling used); **2016**: Sakhalin Energy OBN (some information has now been received from Sakhalin Energy) plus ENL/Rosneft (detailed information is unavailable although general information was provided at the WGWAP-14 meeting);
2. **2015**: Both Sakhalin Energy and ENL/Rosneft (this evaluation has been carried out to the extent possible given the lack of good information concerning the ENL/Rosneft surveys); **2016**: Sakhalin Energy OBN;
3. **2015**: ENL/Rosneft alone (see above comment on lack of information); **2016**: Sakhalin Energy full seismic including OBN.

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 detail as that provided by Sakhalin Energy; failing this, the Panel recommends that ENL and Rosneft undertake simulation exercises similar to those discussed and presented here (Appendix 1) and in the NTF reports (with regard to the Sakhalin Energy survey) for their proposed surveys to evaluate their mitigation strategies.

### 5 PANEL FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

A number of findings, conclusions and recommendations by the Panel appear in the foregoing text. In addition to those (see Table 1 for a summary of recommendations), the Panel reached the following overall conclusions.

In its 14th meeting report (WGWAP-14) the Panel noted that the Sakhalin gray whale population has increased over the last 20 years, which shows that the impacts of industrial and other activities have been within limits that the population can withstand. However, the combined disturbance effects of activities planned for 2015 may exceed anything the population has been subjected to so far. In the case of seismic surveys in 2001 and 2010, a precautionary interpretation of the available information is that the whales shifted their distribution to less ensonified parts of the feeding area although a causal link could not be established with certainty. If both the Sakhalin and ENL/Rosneft surveys go ahead simultaneously as planned, the entire feeding area may be ensonified, such that the whales are not able to evade the impact without compromising their feeding activity.

The pier construction activities on the Piltun spit may cause additional disturbance, although the Panel has very little information on the construction activities expected during June-September 2015: how...
much vessel traffic there will be; what noisy activities, such as pile driving, may be expected; how hydrology of the lagoon will change; etc. (see WGWAP-14 report).

The estimates of sound exposure (Appendix 1) show that the proposed Sakhalin Energy survey alone is predicted to result in higher exposures than the 2010 Astokh 4-D survey, and that the proposed ENL/Rosneft surveys are predicted to result in very much higher exposures than in 2010, assuming a similar sound source as for the Sakhalin Energy survey.

The total effect of activities planned for 2015 may be outside the envelope of impacts that the population has been known to withstand in the past. Before we know whether the population can tolerate disturbance of the degree envisaged for the 2015 summer season (multiple surveys in close spatial proximity spanning much of the feeding season) without demographic consequences, the preferred action from a precautionary point of view would be to postpone the seismic surveys until technologies, such as OBN (also referred to in other contexts as bottom-mounted receivers or ocean bottom seismometers), are available and enable surveying with lower sound energy levels. This applies particularly to the proposed ENL/Rosneft surveys which are predicted to have the highest acoustic impact (see Appendix 1).

The analyses in Appendix 1 estimate that if the source strength could be reduced by half (3 dB), then the acoustic exposure from Sakhalin Energy’s proposed 2015 survey would not exceed that of the 2010 Astokh survey. The Panel was informed that Sakhalin Energy plans an OBN survey in 2016 in an area near the two platforms. The Panel recommends that Sakhalin Energy (and the other operators) reconsider whether any further streamer surveys are really necessary.

If one or both of the proposed sets of streamer surveys are to go ahead, then measures need to be taken to ensure that (a) the disturbance only incrementally exceeds the maximum experienced to date, and (b) both the noise levels and the whale distribution are well monitored in relevant areas and time periods. In particular, this requires:

a) Monitoring of noise levels along all segments of the gray whale feeding area boundary (perimeter monitoring line – PML) that may be ensonified at >156 dB per-pulse SEL by any operation for the duration of the respective operations;

b) Monitoring of whale distribution (from shore) in the entire feeding area at least during the period of peak whale abundance (August-September), and at all other times in those parts of the feeding area expected to be ensonified at >156 dB per-pulse SEL by any operation for the duration of that operation;

c) Not surveying lines which would result in ensonification at >156 dB per-pulse SEL of whales observed inside the PML (the ‘behavioural shutdown’ rule that was in place for the 2010 Astokh survey) (but see note below for exceptions in the period prior to 15 July);

d) Pier construction activities and any other noise-generating activities in or alongshore of the gray whale feeding area from June to September 2015 should be limited to land-based operations that have little or no acoustic or other impact on the adjacent marine environment.

The NTF had recommended that provision (c) be relaxed so as only to prohibit survey of lines when mother-calf pairs are observed shoreward of the PML. The rationale was that (a) mother-calf pairs are probably the most vulnerable component of the population, and (b) suspending operations when any whale is sighted within the specified area would extend the duration of the survey into the period of high whale abundance.

The Panel agrees with the intent of the NTF recommendation but notes that:
a) pregnant females may also be an especially vulnerable component of the population because they need to build up lipid reserves to nurse a calf in the following winter – pregnant females are not readily identifiable in the field and thus protecting them, in effect, requires protecting all whales; and

b) the motivation of not wanting to extend the survey into the period of peak whale abundance means that this relaxation is relevant only to operations prior to the period of peak whale abundance.

Taking these points into account, the Panel accepts the NTF recommendation that the behavioral shutdown rule be relaxed for non-mother-calf animals, but recommends that the relaxation only apply to the period up to 15 July (by which time whale abundance is expected to have reached at least 75% of its maximum level). After 15 July, the behavioral shutdown rule should apply to all whales, not just mother-calf pairs. The Panel thus endorses the MMP specification recommended by the NTF (Annex D of the NTF-8 report), with the added proviso that the exemption for non-mother-calf pairs from the behavioral shutdown rule applies only in the period up to 15 July. The Panel further recommends 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 (but see below).

The probable effect of the behavioral shutdown rule is that several lines within or close to the feeding area will fail to be acquired, unless they can be acquired before 15 July. If data from lines that could not be acquired during the 2015 streamer surveys are found to be essential from an industry perspective, they should be obtained at a later date using alternative (existing or new) technologies with lesser potential impacts on gray whales, such as land-based seismic (for lines close to the coast) or OBN.

The Panel has worked hard and in good faith with Sakhalin Energy over the past two years (plus) to help the Company develop a precautionary but also pragmatic and practical approach to achieving its business objectives without at the same time putting the Sakhalin gray whale population at elevated risk. Having reviewed in detail the information and data available, especially what little we have concerning non-Sakhalin Energy activities, the Panel concludes that from a precautionary perspective, it is not appropriate for the full proposed programmes of both companies to take place in a single season given the major ensonification of almost all of the coastal feeding/nursery grounds.

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 recommends that IUCN passes on this 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 et al. (2013) and are in accord with the MMP developed for Sakhalin Energy’s planned seismic survey. The Panel also recommends that ENL and Rosneft give serious consideration to postponing part or all of their proposed 2015 seismic programmes, which together appear to be of considerably larger scope and potential impact than the proposed Sakhalin Energy programme (see Item 4.2 above, also Appendix 1).

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 (see Item 4.6, above). 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 recommends 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.

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 **strongly recommends** that the companies work together to develop a suitable practical arrangement for 2015 and 2016 that will result in reduced acoustic disturbance on the feeding/nursery grounds and thus would represent an environmentally responsible way forward.

The Panel **emphasizes** that the available data and information are insufficient to make reliable predictions of how the whales will react to the proposed 2015 surveys, hence the need for the precautionary advice provided above. It **stresses** that this uncertainty reinforces the importance of the distribution monitoring component of the MMP (see above). This applies throughout the feeding area and throughout the season and to both Sakhalin Energy and ENL, including the SEIC/ENL Joint Programme. The Panel **concludes** that distributional data should be kept under review throughout the season, and as recommended above, Sakhalin Energy, the Panel and IUCN should arrange for a process similar to that in 2010 for consultation with at least some Panel members for advice during the seismic survey, should the Company decide to proceed with it.

Finally, the Panel **stresses** that the difficulties that have arisen in terms of its ability to provide advice for 2015 were primarily the result of:

1. insufficient time for the Panel to carry out the full analyses required for a survey over twice as extensive as that in 2010, particularly given the late final determination of the seismic sound source and the time by which the Panel’s advice was required;
2. late notification and the lack of information concerning the even more extensive surveys being undertaken by another company;
3. lack of co-ordination between the companies operating in the region with regard to their overall environmental impact.

The Panel **strongly encourages** all stakeholders, including companies and authorities, to ensure that such a situation does not arise again, where there is no single comprehensive examination of the potential overall impact on gray whales (and indeed the environment in general) of more than one company’s activities in a summer season.
Table 1. Summary of recommendations from the 15th meeting of WGWAP

<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>
<th>Sakhalin Energy Response</th>
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<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>
<td></td>
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<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>
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## 5. PANEL FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

### WGWAP-15/004 Item 5
The Panel was informed that Sakhalin Energy plans an OBN survey in 2016 in an area near the two platforms. The Panel **recommends** that Sakhalin Energy (and the other operators) **reconsider** whether any further streamer surveys are really necessary.

<table>
<thead>
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<th>WGWAP Recommendation &amp; Requests</th>
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<tr>
<td>The Panel accepts the NTF recommendation that the behavioral shutdown rule be relaxed for non-mother-calf animals, but <strong>recommends</strong> that the relaxation only apply to the period up to 15 July (by which time whale abundance is expected to have reached at least 75% of its maximum level). After 15 July, the behavioral shutdown rule should apply to all whales, not just mother-calf pairs. The Panel thus <strong>endorses</strong> the MMP specification recommended by the NTF (Annex D of the NTF-8 report), with the added proviso that the exemption for non-mother-calf pairs from the behavioral shutdown rule applies only in the period up to 15 July.</td>
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<th>Target Completion Date</th>
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<td>As soon as possible</td>
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<th>Sakhalin Energy Response</th>
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<td>Sakhalin Energy, ENL and Rosneft</td>
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| Immediate |

The Panel **recommends** 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.

Sakhalin Energy, ENL and Rosneft

Immediately

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**Item 5**

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 **recommends** 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 et al. (2013) and are in accord with the MMP developed for Sakhalin Energy’s planned seismic survey. The Panel also **recommends** 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.

IUCN, ENL and Rosneft

Immediately

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**Item 5**

Inevitably, the Panel has better information on the Sakhalin Energy programme given that company’s extensive cooperation 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 **recommends** that Sakhalin Energy gives serious consideration to the

Sakhalin Energy

Immediately
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<tr>
<td>WGWAP-15/009</td>
<td>Item 5</td>
<td>possibility of postponing its seismic survey until 2016 and combining streamer and OBN technologies as previously anticipated.</td>
<td>Sakhalin Energy, ENL, Rosneft</td>
<td>As soon as possible</td>
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<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>
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REFERENCES


APPENDIX 1. PREDICTIONS OF MAXIMUM AND CUMULATIVE SOUND EXPOSURE FOR SAKHALIN GRAY WHALES FROM SAKHALIN ENERGY’S PROPOSED 4D SEISMIC SURVEY IN 2015, WITH COMPARATIVE PREDICTIONS FOR OTHER SURVEYS

By Justin G. Cooke

INTRODUCTION

A model was constructed to simulate of the seismic survey planned by Sakhalin Energy for 2015 near Piltun, in order to estimate the expected maximum and cumulative levels of sound exposure of gray whales under various scenarios. Rough simulations were also conducted for comparative purposes of the 2010 Astokh survey, and the surveys planned for 2015 by DMNG in the Odoptu-More, North Chayvo, Chayvo and Arkutun-Dagi blocks, on the assumption of a noise source similar to that planned for the 2015 Sakhalin Energy survey.

The two main mitigation measures included in the base scenario are: (i) shutdown whenever a gray whale is seen within 2 km of the source (‘injury shutdown’); and (ii) shutdown when mother-calf pairs [or any whales after 15 July] are seen within the designated feeding area in a position subject to a predicted sound level exceeding 156 dBSEL (‘behavioural shutdown’). Strengthening or relaxation of these measures is examined in alternative scenarios.

The scope of this work was specified in the 7th and 8th reports of the Noise Task Force of the Western Gray Whale Advisory Panel (IUCN 2014a, b). The purpose of this analysis is to estimate the likely population-level sound exposure from the proposed seismic survey in order to help determine whether the proposed mitigation measures are appropriate and sufficient from a whale conservation perspective, and to put the proposed survey in the context of the other past and proposed surveys in the north-eastern Sakhalin coastal area.

MODEL SPECIFICATION

Survey parameters for the Piltun survey for Sakhalin Energy

The area to be surveyed for Sakhalin Energy in 2015 is shown in Fig. 5 of the WGWAP 14 report (IUCN, 2014c). Survey lines were parallel and spaced 300 m apart, more or less parallel to the western boundary of the survey block. This resulted in 47 lines with an average length of 34.1 km.

The survey speed was 2.57 m/s with shots every 18.75 s, making about 85,000 planned shots in total. Turn time between lines was assumed to be 4.5 hours (to allow for time-sharing), and each 6-hour period had a 10% chance of being unusable due to bad weather. A 20-minute linear ramp-up was assumed at the start of each line. A start date of 10 June was assumed. The survey was ended on 31 July even if it was not complete (this happened very rarely).

Lines nearest the coast were assumed to be shot with highest priority. That is, the nearest unshot line to the coast was normally selected. However, if a line near the coast was aborted due to sighting of whales (see criteria below), then the furthest unshot line from the coast was selected next, after which a further attempt was made to shoot the uncompleted line nearest the coast.

Sound field

The sound field from the source was modelled approximately as a product of functions of distance and angle from the source with parameters supplied by R. Racca for eight compass points. Between the compass points, the relative strength by direction was interpolated as a cosine series. This resulted in the following function for sound level as a function of distance $r$ (in km) and angle $\theta$ (in radians, relative to vessel travel direction):
The formula is not designed to be accurate for $r < 1$ km.

**Whale density**

The shore-based density data by 1 km square from the years 2005-2009 were averaged to produce a relative density distribution.

The distribution of whales was generated anew at the start of each survey line, and whales were assumed to remain stationary while the line was surveyed. Each time the distribution was recalculated, each whale was randomly allocated to a square in proportion to the relative density for that square. The position of the whale within the square was chosen randomly and uniformly.

The total population in the area was assumed to increase linearly from zero on 1 June to a maximum of 100 whales (including 15 mother-calf pairs) on 31 July (base case) or 15 June (alternative case motivated by 2010 shore-based data which show no increase after mid-June).

**Detection**

It was assumed that the shore-based observer points fully cover the area within the feeding ground as defined by the Perimeter Monitoring Line (PML), and that all whales within this area are seen. In practice, this is relevant only for the area impacted by the survey (>156 dB SEL). Sightings within the feeding ground but outside the ensonified area have no effect on survey operations.

Outside the feeding ground, detection was assumed to be from the survey vessel itself. The assumed detection function was based on what is reasonable for medium-sized whales and two observers on duty. The probability of seeing a surfacing whale a distance $r$ from the vessel and angle $\theta$ from the trackline was taken to be: $p = 0.5 \exp\left(-\frac{(r/2.5\text{km})^2}{\text{cos}\theta}\right)$. With a surfacing rate of 40/hr, this implies a trackline sighting probability of $g(0) = 0.99$. Once detected, a whale was assumed to be kept in view until it passed abeam.

As an alternative, the detection probability for a surfacing was set to 50% of its base-case value in hours of darkness to simulate the use of night-vision technology. Six hours of darkness per day was assumed.

**Mitigation**

There are two shutdown criteria in the base scenario:

1. ‘behavioural shutdown’ when a mother-calf pair (after 15 July: any whale) is sighted inside the PML at a position expected to be ensonified at more than 156 dB from the current survey line.
2. ‘injury shutdown’ when a whale is seen within 2 km of the active survey vessel on any line.

A behavioural shutdown was assumed to take place whenever a sighted whale was within the area within the PML that was exposed to >156 dB. An injury shutdown was assumed to be initiated whenever a whale was detected within 2 km of the survey vessel. When a shutdown took place, the remainder of the line was aborted. The entire line had to be reshot at a later date. Because of time-sharing with other operators, each line was assumed to start at its scheduled time, even if the previous line was not completed. This can result in wasted time between lines. Up to five attempts to survey a line were made before the line was abandoned.

An alternative scenario considered was a behavioural shutdown for any whale at any time (not just for mother-calf pairs, even before 15 July).

**Other surveys**

For comparative purposes, the 2010 Astokh survey was also simulated, on the assumption that the sound source had the same strength and directional profile as that to be used in 2015. The behavioural shutdown rule applied for all whales, not just mother-calf pairs.
Few details are available for the surveys that are apparently to be conducted in 2015 by DMNG for ENL in the Odoptu-More, Chayvo and Arkutun-dagi blocks and for Rosneft in the North Chayvo block (IUCN 2014c). In order to obtain a rough indication of the possible ensonification caused by these surveys, scenarios were generated in which these surveys used a sound source equivalent to that used in the survey for Sakhalin Energy, with the same line spacing (300 m). It was assumed that the entire blocks would be surveyed. The approximate locations of these blocks are shown in Fig. 5 of the WGWAP-14 report (IUCN, 2014c). It is unclear what mitigation measures are proposed for these surveys, but it was assumed that a shutdown radius of 2 km applies to gray whale sightings. Scenarios with and without the behavioural shutdown criterion were tested.

The North Chayvo, Chayvo and Arkutun-Dagi blocks, which are contiguous, were treated as a single block for survey purposes with the label CAD: survey lines can span blocks within this group. The North Chayvo block extends to the coast, but the survey vessel was assumed to remain at least 1 km offshore.

**Scenarios and performance statistics**

The scenarios tested are listed in Table 1. 500 replicates of each scenario were simulated.

<table>
<thead>
<tr>
<th>Table 1. List of scenarios simulated</th>
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<tbody>
<tr>
<td>A Base case</td>
</tr>
<tr>
<td>B Early migration</td>
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<tr>
<td>C Poor night vision</td>
</tr>
<tr>
<td>D All whales</td>
</tr>
<tr>
<td>E Half intensity</td>
</tr>
<tr>
<td>F 2010 Ashtok survey</td>
</tr>
<tr>
<td>G DMNG and SEIC surveys</td>
</tr>
<tr>
<td>H DMNG surveys only with behavioural shutdown</td>
</tr>
<tr>
<td>I DMNG surveys only, no behavioural shutdown</td>
</tr>
<tr>
<td>J DMNG surveys only, no behavioural shutdown</td>
</tr>
<tr>
<td>K DMNG and SEIC surveys</td>
</tr>
<tr>
<td>L DMNG and SEIC surveys, no behavioural shutdown</td>
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</tbody>
</table>

For each whale, the maximum and cumulative sound exposure was recorded. The cumulative exposure was calculated by converting each shot exposure to a received energy value, summing up the received energies across shots, and converting back to dB. Cumulative distributions (across whales and replicates) of maximum and cumulative exposure were computed.

For each simulated line shoot, it was recorded whether the line was: (a) completed, (b) aborted due to behavioural shutdown, or (c) aborted due to injury shutdown. The mean numbers in each category were computed for each scenario.
RESULTS AND DISCUSSION

Cumulative distributions of maximum and cumulative exposure (summed over whales and replicates) for scenarios A through F (involving Sakhalin Energy surveys only) are shown in Figures 2 and 3 respectively. Histograms of mean numbers of completed and aborted lines by scenario are shown in Figure 4.

---

6 Figure 1 is intentionally missing
With the exception of scenario B where the whales arrive early, a substantial proportion of the whales receive no ensonification at all, because they arrive after completion of the survey.

The results show that relatively few injury shutdowns are expected, and that this measure does not appreciably hold up the survey. For this same reason, the effectiveness of night vision (scenario C) is unimportant. Results for scenario C are not shown in the figures because they are essentially identical to scenario A results in terms of exposures.

The behavioural shutdown criterion causes relatively little delay in the base scenario because few mother-calf pairs are encountered. Extending the behaviour shutdown to cover all whales (and not just mother-calf pairs) is predicted to substantially extend the survey length and to increase the number of whales exposed to medium levels of sound, but not to greatly affect the number of whales exposed to higher sound levels (scenario F). The extended shutdown criterion adds to the sound exposure mainly by extending the survey into the period when more whales are present. An additional effect is the extra sound generated by reshooting aborted lines. Under the assumption of a maximum of 5 attempts per line, not all near-shore lines would be completed under the extended shutdown criterion (Fig. 4).

If the whales arrive early (scenario B), as may have happened in 2010, somewhat more time is predicted to be lost to behavioural and injury shutdown, and the expected maximum and cumulative sound exposure is greatly increased. The near-shore lines would likely not be fully acquired under these circumstances.

The 2010 Astokh survey (scenario H) is estimated to have caused considerably less maximum and cumulative exposure than the proposed 2015 survey. Reduction of the 2015 source level by half (3dB) would bring down the 2015 exposures to below the levels of the 2010 survey (compare scenarios G and H), in addition to reducing shutdown time and ensuring survey completion.

**Comparisons with surveys by other operators**

Cumulative distributions of maximum and cumulative exposures from scenarios involving different surveys are shown in Figures 5 and 6. The combination of the Piltun survey (for Sakhalin Energy) and the DMNG surveys in the Chayvo, North Chayvo, Arkutun-Dagi and Odoptu-More blocks (for
ENL and Rosneft) is predicted to substantially increase the maximum and cumulative exposures relative to the Sakhalin Energy survey alone, even if the same behavioural shutdown rule is applied. The proposed DMNG surveys dominate the picture in the sense that the exposure due to the DMNG surveys alone is almost as much as that due to the combination of DMNG and Sakhalin Energy surveys.

Fig. 5. Distribution of maximum exposure for different options/surveys

Fig. 6. Distribution of cumulative exposure for different options/surveys
As noted above, the North Chayvo, Chayvo and Arkutun-Dagi blocks were combined into a single CAD block for the purpose of this analysis, of which the North Chayvo block is the one closest to the shore. If the behavioural and injury shutdown rules are applied, it is likely that several near-shore lines in the Odoptu-More and North Chayvo blocks cannot be fully acquired (Fig. 7). However, if no behavioural shutdown rule is applied, the exposure for the combination of surveys is predicted to be even higher.

**Fig. 7. Mean number of completed and aborted lines by case: various surveys**

It should be emphasized that the predictions for the exposures from the DMNG surveys are based on very little information. Because they indicate a potential for high acoustic exposures of Sakhalin gray whales, it is important that an analysis of the kind presented in this Annex be carried out based on more specific information about the surveys.

**REFERENCES**


ANNEX 1. LIST OF PARTICIPANTS

Panel Members

Justin G. COOKE
Centre for Ecosystem Management Studies
Höllenbergstr. 7
79312 Emmendingen
Germany

Greg P. DONOVAN
Head of Science
International Whaling Commission
The Red House, 135 Station Road
Impington, Cambridge CB24 9NP
UK

Douglas P. NOWACEK
Duke University
Nicholas School of the Environment &
Pratt School of Engineering
135 Duke Marine Lab Rd.
Beaufort, NC 28516
USA

Randall R. REEVES (Chairman)
Okapi Wildlife Associates
27 Chandler Lane
Hudson
Québec J0P 1H0
Canada

Glenn R. VANBLARICOM (Day 2)
School of Aquatic and Fishery Sciences
Fishery Sciences Building, Rm. 116
1122 NE Boat Street
Seattle, Washington 98105
USA

Alexander I. VEDENEV
Head of Noise in Ocean Laboratory
PP Shirshov Institute of Oceanology
Russian Academy of Sciences
Nakhimovskiy Ave, 36
Moscow 117997
Russia

David W. WELLER
Marine Mammal & Turtle Division
Southwest Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
8901 La Jolla Shores Drive
La Jolla, CA 92037-1022
USA

Alexey V. YABLOKOV
Councillor
Russian Academy of Sciences,
Leninsky prospect, 33, office 319
Moscow 119071
Russia

Associate Scientist
Brandon SOUTHALL (Day 1)

IUCN
Anete BERZINA
Gerard BOS (Day 1)

Interpreter
Alexander DANILOV
## ANNEX 2. AGENDA

### AGENDA

<table>
<thead>
<tr>
<th>8-9 December 2014</th>
<th>Documents</th>
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<td><strong>06:30 PST</strong>&lt;br&gt;<strong>09:30 EST</strong>&lt;br&gt;<strong>14:30 GMT</strong>&lt;br&gt;<strong>15:30 CET</strong>&lt;br&gt;<strong>17:30 MSK</strong></td>
<td><strong>1. Agreement on agenda and objective, timetable and reporting procedures (Reeves, Berzina)</strong>&lt;br&gt;1.1. Agree on the main objective/purpose of WGWAP-15 report;&lt;br&gt;1.2. Who will prepare first drafts of different sections?&lt;br&gt;1.3. How to obtain Panel-wide consensus (‘quorum’) on text by Friday, 12 December 2014?</td>
</tr>
<tr>
<td></td>
<td><strong>2. Documents to consider (including Observer input and SEIC Response)</strong></td>
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<tr>
<td></td>
<td><strong>3. Summary of key findings and items still pending from NTF-8 (Donovan, other NTF members)</strong></td>
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<td></td>
<td><strong>4. Results of Cooke cumulative exposure simulation work (Cooke)</strong></td>
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<tr>
<td></td>
<td><strong>5. Determination of Panel findings, conclusions, recommendations (Reeves):</strong>&lt;br&gt;5.1. Immediate concerns;&lt;br&gt;5.2. Longer-term concerns;&lt;br&gt;5.3. How to manage distinctions (re 2015) in our report among scenarios of:&lt;br&gt;5.3.1. SEIC survey in isolation;&lt;br&gt;5.3.2. ENL survey in isolation;&lt;br&gt;5.3.3. ‘Time-share’ simultaneous surveys by both companies;&lt;br&gt;5.3.4. Aggregate activities (including ENL pier construction work, satellite tagging, other seismic surveys etc.)</td>
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### ANNEX 3. LIST OF DOCUMENTS

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<tr>
<td>WGWAP-15/1</td>
<td>Final agenda (including time schedule)</td>
<td>English</td>
<td>Public</td>
</tr>
<tr>
<td>WGWAP-15/2</td>
<td>List of documents distributed in connection with the 15th meeting of the WGWAP</td>
<td>English</td>
<td>Public</td>
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<tr>
<td>WGWAP-15/3</td>
<td>WGWAP 7th Noise Task Force Meeting (NTF-7) Meeting Report, 2014</td>
<td>Russian</td>
<td>Public</td>
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<tr>
<td>WGWAP-15/5-1 (Revised)</td>
<td>A technical note on the Predictions of cumulative sound exposure for Sakhalin gray whales from the proposed 4D survey for Sakhalin Energy in 2015, submitted by J.Cooke</td>
<td>English</td>
<td>Confidential</td>
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<td>WGWAP-15/5-2</td>
<td>J.Cooke’s presentation of a technical note on the Predictions of cumulative sound exposure for Sakhalin gray whales from the proposed 4D survey for Sakhalin Energy in 2015</td>
<td>English</td>
<td>Confidential</td>
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<tr>
<td>WGWAP-15/5-2 (Addendum)</td>
<td>Addendum to J.Cooke’s presentation of a technical note on the Predictions of cumulative sound exposure for Sakhalin gray whales from the proposed 4D survey for Sakhalin Energy in 2015, to include exposure calculations comparing SEIC only, ENL only, and the combined surveys</td>
<td>English</td>
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<td>WGWAP-15/6-1</td>
<td>Written comments received from ENVIRON, as part of the open written consultation and review process, organized ahead of WGWAP-15 for WGWAP Observers to react to the MMP-related outputs of NTF-7 and NTF-8</td>
<td>English</td>
<td>Confidential</td>
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<tr>
<td>WGWAP-15/6-2</td>
<td>Written update received from Sakhalin Energy with the latest update since NTF-8 on OBN &amp; time-sharing issues in response to the ENVIRON comments (WGWAP-15/6-1)</td>
<td>English</td>
<td>Confidential</td>
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<td>WGWAP-15/7</td>
<td>Written response received from Sakhalin Energy with regards to the Panel’s questions on OBN survey issues</td>
<td>English</td>
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<td>WGWAP-14/REPORT</td>
<td>Report of the 14th meeting of the Western Gray Whale Advisory Panel (WGWAP-14), 2014</td>
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<td>Public</td>
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