WESTERN GRAY WHALE ADVISORY PANEL **NTF-3**

NOISE TASK FORCE

REPORT OF THE NOISE TASK FORCE AT ITS 3RD MEETING

2-3 NOVEMBER 2012

BUSAN, REPUBLIC OF KOREA

CONVENED BY THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE

Report of the 3rd Meeting of the Noise Task Force

PARADISE HOTEL, BUSAN, REPUBLIC OF KOREA, 2-3 NOVEMBER 2012

CONTENTS

ACRONYMS

AIC	Akaike Information Criterion
ANSI	American National Standards Institute
Company	Sakhalin Energy Investment Company
CPA	Closest Point of Approach
cSEL	cumulative Sound Exposure Level
EEZ	Exclusive Economic Zone
FDA	Functional Data Analysis
HR/UHR	High Resolution/Ultra-High Resolution
IUCN	International Union for Conservation of Nature
MMP	Monitoring and Mitigation Programme
MNR	Russian Ministry Of Natural Resources and Ecology
MV	Motor Vessel
MVA	Multivariate Analysis
NOAA	National Oceanic and Atmospheric Administration
NTF	Noise Task Force
PCoD	Population Consequences of Disturbance
PCI	Potential Cumulative Impact
POI	Pacific Oceanological Institute
PML	Perimeter Monitoring Line
RV	Research Vessel
SEIC	Sakhalin Energy Investment Company
SEL	Sound Exposure Level
SPL	Sound Pressure Level
WGW	Western Gray Whale
WGWAP	Western Gray Whale Advisory Panel

1 INTRODUCTORY ITEMS

The 3nd meeting of the Noise Task Force (hereafter NTF) was held at the Paradise Hotel, Busan, Republic of Korea, from 2-3 November 2012 under the chairmanship of Greg Donovan.

The list of participants is given as Annex A.

A list of acronyms is given at the beginning of the report.

1.1 Chairman's opening remarks

The Chair noted that the primary tasks of the meeting were to: (1) review progress and results of the analyses arising from the 4D seismic survey in 2010; (2) receive a report of the 2012 2D seismic survey and discuss plans for future analyses of the data; (3) review noise-related aspects of future activities (including an update on future seismic surveys); (4) review the status of noise-related recommendations.

The Chair recognised the difficulties in being able to complete an agreed full report prior to the WGWAP in the time available. He would give priority to reaching agreed recommendations although every effort would be made to try to get a fully agreed report by the end of the WGWAP meeting. Otherwise the report would have to be completed by e-mail. As in the past, he would present a Chair's summary to the WGWAP meeting.

1.2 Available documents

At the start of the meeting, the only new document was the draft agenda. Previous WGWAP and NTF reports are available on the IUCN WGWAP website (http://www.iucn.org/wgwap/).

The Task Force was informed that PowerPoint presentations would be given by Sakhalin Energy Investment Company Limited (hereafter 'the Company') on a number of topics:

(1) various 4D analyses;

(2) conduct of the 2D seismic survey and the monitoring and mitigation measures put in place.

Some background documents were also circulated during the meeting with respect to the behavioural MVA, the distance from shore MVA and the proposed analyses for the density MVA. These are listed in Annex C.

1.3 Adoption of Agenda

A draft agenda had been circulated and discussed during a conference call. Some further minor modifications were made and the final agenda is given as Annex B.

2 PROGRESS ON GENERAL RECOMMENDATIONS/SUGGESTIONS FROM NTF-2 AND WGWAP-11

This section of the report reviews progress made on those recommendations and suggestions made at earlier meetings that are not covered by specific items in the agenda. To assist those reading the report who were not present at the meeting, the text of those recommendations is included at the start of each sub-item.

Later in the meeting, the NTF discussed the need for special action if a Panel recommendation (especially one that was originally developed within a Task Force) is rejected by the Company. This discussion and a proposed course of action are given under Item 2.7.

2.1 WGWAP-11/001: IUCN progress report on dealing with 'continuous' recommendations

At its last meeting, the Panel had noted in recommendation WGWAP-11/001 that:

> *"The Noise and Environmental Monitoring Task Forces had both noted that many recommendations include an expectation that a policy or procedure will be adopted as regular practice. Once the Company has responded favourably to such a recommendation, it is considered Closed – implemented. However, in view of turnover in the company and changes in company practice over time, there is a need to ensure that implementation continues to be tracked. The Panel* ***recommends*** *that IUCN work on this matter with the Panel Chair and report back no later than at WGWAP-12."*

Saksina reported that after consultation with the WGWAP Chair, IUCN had introduced a new additional category of recommendations status – *'Closed - implemented/resolved satisfactorily but needs to be tracked regularly'* – for 'continuous' recommendations that must be revisited on a regular basis. As a minimum, IUCN will need to receive an update on their status from the WGWAP Chair (after consultation with relevant Task Forces or parties responsible for their implementation) before every WGWAP meeting to ensure that their status is up-to-date. The summary table of recommendations provided on the website will be clearly date stamped.

The Chair thanked IUCN and the WGWAP Chair for their work and **endorsed** approach. The NTF **also recommended** that in order to facilitate easy recognition of extant recommendations, those that are 'closed' and completely finished or superseded should be clearly identified (e.g. by shading). It **further recommended** that the table should be updated and posted on the website as soon as possible after agreement on status has been reached. IUCN will email Panel members and the Company when updates to the table are posted on the website.

2.2 WGWAP-11/003: review identified periods of loud noise

Text of original recommendation WGWAP-11/003
Objective To investigate identified periods of loud noise within the feeding grounds in more detail with regard to both the activities underway and the acoustics data recorded. This investigation will attempt to (a) identify the cause(s) of the noise and (b) determine the extent (i.e., sound exposure) of the potential threat or disturbance, so that mitigation can be improved in the future, recognising that the sources of the loud noise are likely not SEIC activities. **Reporting/data requirements** According to the impulse noise format described in recommendation WGWAP-7/002, the Panel wishes to analyse the data from the following acoustic buoys on the dates indicated: Buoys A10, Odoptu N10, Odoptu-S-20 and Odoptu N20 for the periods 25-30 August, and 11-20 September; and Buoy OFA, 1-7 September 2010. **Responsible Party/Parties** Sakhalin Energy, IUCN, Panel **Target Completion Date** Data submitted to IUCN by 31 May 2012 and circulated to the Panel, Panel provides report at least three weeks before WGWAP-12

The Task Force noted that Panel recommendation WGWAP-11/003 (above) had been taken directly from the NTF's report. In its response to the Panel report, the Company stated:

> *"Sakhalin Energy runs such investigation under Integrated Analysis. Sakhalin Energy rejects the second part of recommendation and requests Panel to clarify what type of the analysis should be conducted."*

The Chair commented that it was disappointing that a recommendation developed and agreed by all members of the Task Force, drafted in accordance with the new recommendations template, had been rejected in June as part of the Company's response to Panel's report. Nowacek further noted that format for the processed data specified would allow the Panel's review of the identified loud noise periods without a need for further analysis and that it had already been specified that the source of the noise was probably not SEIC activities. The Panel's responsibility was to investigate factors that may adversely affect gray whales, irrespective of the company of origin.

Vladimirov noted that in addition to the Company comments above, there is an issue of the ownership of the data which is shared by Exxon and/or the Pacific Oceanological Institute (POI). He also noted that legally they cannot provide raw data. The Chair noted that the recommendation had not intended to request raw data but rather processed data. Vladimirov noted that there may have been a misunderstanding.

The Chair reiterated the importance of this issue, not only for this specific recommendation which was similar to that of the response to recommendation WGWAP-11/007 (see Item 2.3 below) but also in general terms with respect to the co-operative approach to issues developed within the work of Task Forces. It was **agreed** to return to this after the SEIC members had a chance to consult amongst themselves. The outcome of the general discussions can be found under Item 2.7.

With respect to this specific recommendation, the Company provided additional information on the difficulties they had with respect to its implementation. They noted that during the period 18th August to 13th November 2010, Rosneft were acquiring seismic data in an adjacent area. Rosneft had commissioned an independent monitoring study with POI covering the entire period of their survey, which has been published by Dr Rutenko in the Journal *Acoustical Physics* but not in the detail useful to the NTF. If the Company supplied the detailed data set requested, they would potentially expose themselves to litigation. They therefore suggested that the best way to obtain the data required would be for IUCN on behalf of the Panel to request the Regulator (MNR) to either instruct Rosneft to provide the relevant data or for Sakhalin Energy to release their data.

In the light of this new information and advice, the NTF developed the consolidated recommendations below to supersede WGWAP-7/002 and WGWAP-11/003. Should these be adopted by the Panel, the NTF **agreed** that the table of recommendations should be amended accordingly.

Text for consolidated new recommendation based on WGWAP-7/002 on the presentation of requested acoustic data
Objective To facilitate presentation of results to the Panel for specific acoustic data requests for specified tasks and time periods. **Data requirements/analyses** For any and all future requests for acoustic data, Sakhalin Energy will provide tabular data for fully calibrated 1-Hz bands, 1-minute averages for continuous noise and 3-second averages for impulsive noise in frequency bands specified in the request. **Responsible persons** Sakhalin Energy for ensuring the data, when requested, are provided in the format described herein. **Timeline** Deadlines for providing the requested data in the specified format will be determined for each individual request.

Text for consolidated new recommendation based on WGWAP-11/003 on identified periods of loud noise
Objective To investigate identified periods of loud noise within the feeding grounds in more detail with regard to both the activities underway and the acoustics data recorded. This investigation will attempt to (a) identify the cause(s) of the noise and (b) determine the extent (i.e., sound exposure) of the potential threat or disturbance, so that mitigation can be improved in the future, recognising that the sources of the loud noise are likely not SEIC activities. **Reporting/data requirements** IUCN on behalf of the WGWAP will request the Regulator (MNR) to (1) provide the Panel with the Rosneft monitoring report for the period 18 August to 13 November 2010 and (2) authorise the Company to release the relevant acoustic data in the impulse

noise format described in modified recommendation WGWAP-7/002 above, from the following acoustic buoys on the dates indicated: Buoys A10, Odoptu N10, Odoptu-S-20 and Odoptu N20 for the periods 25-30 August, and 11-20 September; and Buoy OFA, 1-7 September 2010.

Responsible Party/Parties

IUCN, Panel and if MNR accede to this request, the Company

Target Completion Date

IUCN will submit the request to MNR in Russian by 20 November 2012. Assuming the data are received in a timely fashion, the Panel will provide its report at least three weeks before WGWAP-13.

2.3 WGWAP-11/007: improved process for initial analysis of acoustic data

Text of original recommendation WGWAP-11/007

Objective

To provide a more constructive and productive means of initial analysis and examination of acoustic data, consistent and adequate summaries of data on temporal patterns of noise must be submitted to the Panel for consideration. In addition, the original time series of data must be available for more detailed analysis of specific events of interest. This new process should facilitate the most efficient and productive review of acoustic data by the Panel and NTF.

Reporting/data requirements

All original time-series data should continue to be collected and stored by the Acoustic Monitoring Group at the Pacific Oceanological Institute (POI). This is not a new request but reflects the critical importance of full archival preservation of the original data.

Modified WGWAP recommendation 7/002 specifies the need for the reporting of data on specific acoustic events on relatively fine temporal (1-s for impulse noise; 1-min for continuous noise) and spectral (1-Hz band) scales. While data must be made available upon request on these fine scales for specific events, this is not a regular requirement for all sensors and all sampling periods. However, to expedite the release of 'event' data in a timely and efficient manner Sakhalin Energy has agreed to include in its contract with POI a requirement that all raw acoustic data be pre-processed and archived as time-indexed frequency-resolved records (e.g. through the computation of simple, non-averaged spectrograms). This operation will minimise the time needed by POI to fulfil subsequent requests for data.

For each season, beginning with 2012, the following tabular and graphical summary representations of the acoustic data should be included in, or enclosed in digital format with, the reports. Specifically, each annual report would include for every recording station and all available data periods:

* Tabular summaries in digital format of 30-min Leq levels in 1/3-octave bands between 10Hz and 10kHz (ANSI standard centre frequencies)

* Graphs showing sequential 1-min Leq values for the 20Hz-2 kHz and 20 Hz-15 kHz passbands (presented chronologically with ~3 days data/graph)

* Distinct spectrograms showing a) 1-min averages in the range 20Hz-2kHz on a linear frequency scale and b) 1-min averages in the range 20Hz-15kHz on a logarithmic frequency scale. For completeness and ease of reference, the 2-20 Hz frequency range could be shown on a common time axis alongside the 20Hz-15kHz logarithmic spectrograms, but should be segregated and rendered separately with an independent colour scale so as not to restrict the dynamic range of the >20 Hz data.

Responsible Party/Parties

Sakhalin Energy, IUCN

Timeline

The company should submit a report annually through IUCN in document and/or digital form that contains the data as described above. Sakhalin Energy and IUCN will develop an efficient method to transfer and circulate this material to the Panel and/or Task Force members as appropriate.

The Chair noted that this is a 'continuous' recommendation beginning with the 2012 season (although Broker noted that it had also been used for the 2011 data). It had been developed and agreed by the Noise Task Force and adopted unchanged by the Panel. In its response to the Panel's report in June, Sakhalin Energy had rejected this recommendation stating:

> "Sakhalin Energy cannot implement this recommendation due to rights of acoustic data ownership. Sakhalin Energy will make the decision on repository of acoustic data and contractual relations with institutes inside and outside Russia."

The Chair noted the similarities of this to the consideration of WGWAP-11/003 under Item 2.2 and it was agreed that it should be dealt with in the same manner, i.e. the NTF would return to this after the Company members had a chance to consult amongst themselves. The outcome of the general discussions can be found under Item 2.7.

With respect to this specific recommendation, the Company clarified that it had no difficulties with the substance of the recommendation, including the continued critical importance of full archival preservation of the original data which it understood and was already fulfilling. Rather, its difficulties related to the use of some wording that could be interpreted as requesting raw data and with other wording that dealt directly with one of its contractors rather than simply referring to the Company itself.

In the light of this, the NTF developed the consolidated recommendation to supersede WGWAP-11/007 given below. Should this be adopted by the Panel, the NTF **agreed** that the table of recommendations should be amended accordingly.

Text for consolidated new recommendation based on WGWAP-11/007
Objective The submission of consistent and adequate summaries of data on temporal patterns of noise to the Panel for consideration in order to facilitate a more constructive and productive means of initial analysis and examination of acoustic data. It will also facilitate a timely analysis of specific acoustic events. **Reporting/data requirements** Modified WGWAP recommendation 7/002 specifies the need for the reporting of data on specific acoustic events at the request of the panel on fine temporal (3-s for impulse noise; 1-min for continuous noise) and spectral (1-Hz band) scales. While data must be made available upon request on these fine scales for specific events, this is not a regular requirement for all sensors and all sampling periods. However, to expedite the release of 'event' data in a timely and efficient manner, it is strongly recommended that all raw acoustic data be pre-processed and archived as time-indexed frequency-resolved records through the computation of short-time (3 seconds) averaged spectrograms in fully calibrated 1-Hz bands. For each season, beginning with 2012, the following tabular and graphical summary representations of the acoustic data should be included in, or enclosed in digital format with, the reports. Specifically, each annual report would include for every recording station and all available data periods: * Tabular summaries in digital format of 30-min Leq levels in 1/3-octave bands between 10Hz and 10kHz (ANSI standard centre frequencies) * Graphs showing sequential 1-min Leq values for the 20Hz-2 kHz and 20 Hz-15 kHz passbands (presented chronologically with ~3 days data/graph) * Distinct spectrograms showing a) 1-min averages in the range 20Hz-2kHz on a linear frequency scale and b) 1-min averages in the range 20Hz-15kHz on a logarithmic frequency scale. For completeness and ease of reference, the 2-20 Hz frequency range could be shown on a common time axis alongside the 20Hz-15kHz logarithmic spectrograms, but should be segregated and rendered separately with an independent colour scale so as not to restrict the dynamic range of the >20 Hz data. **Responsible Party/Parties** The Company is responsible for ensuring the pre-processing and archiving of the acoustic data as recommended. It will provide the annual acoustic summaries to IUCN in a timely manner for consideration by the Panel at its meetings; IUCN is responsible for promptly making the summaries available to the Panel. **Timeline** The company should submit a report annually through IUCN in document and/or digital form that contains the data as described above. Sakhalin Energy and IUCN will develop an efficient method to transfer and circulate this material to the Panel and/or Task Force members as appropriate.

2.4 WGWAP-11/006: activities document

Text of recommendation WGWAP-11/006
Objective The Panel has a responsibility to review, evaluate and advise on Sakhalin Energy activities that may have impacts (including in a cumulative manner) on western gray whales (e.g. with respect to noise, damage to benthos, oil spill risk). This requires that the Panel is made aware of planned 'new' activities as well as any changes to ongoing activities well in advance of these becoming operational. **Reporting/data requirements** It would be valuable and efficient to have a single 'activities' document that can be updated regularly (at a minimum, immediately prior to WGWAP meetings). Items to be summarised include: • numbers, types, locations and general operating patterns of marine vessels working for Sakhalin Energy (e.g. supply vessels, oil spill response vessels, standby vessels, accommodation vessels, diving vessels, *ad hoc* activities); • changes to 'regular' operations (e.g. drilling, well conductor driving, maintenance and project activities); • potential or actual specific/unusual activities (e.g. seismic surveys, pipeline stabilization, construction works) – with notification as early as possible; • timelines of such activities throughout the season or seasons (to allow consideration of aggregate activities). Where changes occur, there should be a concise explanation of why they are necessary, a summary of options considered, an evaluation and risk assessment of any possible impacts and a presentation of measures proposed by the company to ensure that disturbance or other effects on gray whales are minimised. As appropriate, this should include an explanation as to why certain potentially applicable mitigating measures were not adopted. **Responsible Party/Parties** Sakhalin Energy **Timeline** Sakhalin Energy should report at least annually in document form, consistent with its normal business planning cycle. Information must reach the Panel sufficiently in advance to ensure that any ensuing recommendations can be used by the company to modify its plans if necessary. Large-scale activities such as those involved in the South Piltun development, seismic surveys etc. are best dealt with (as has been the case) as separate exercises with considerably more lead time and detailed information must be provided well in advance. It is recognised that the task force approach may need to be used for such cases.

The Chair noted that last year, the Panel had developed recommendation WGWAP-11/006 whose objective was to ensure that it received relevant information in a consistent format of planned 'new' activities by the Company, as well as any changes to ongoing activities well in advance of these becoming operational. This was to facilitate the Panel's ability review, evaluate and advise on activities that may have impacts (including in a cumulative manner) on western gray whales (e.g. with respect to noise, damage to benthos, oil spill risk). This recommendation is of broader relevance than just for the NTF which will consider only on those aspects related to noise.

Evans summarised the available information on future activities, noting that no new activities were planned that had not been reported at WGWAP-11 meeting[1]. In terms of the future work of the NTF, it was **agreed** that the primary issues arising out of this report to be addressed related to seismic surveys (LUN-A and PA-B 4D – these will take place in 2014 or later) and with analogue seabed surveys (bathymetry and side scan sonar). These are considered further under Item 6.2. Activities related to the proposed South Piltun development are dealt with elsewhere (see Item 4).

[1] http://iucn.org/wgwap/wgwap/meetings/wgwap_11/

2.5 IUCN WGWAP website and the Seismic Survey Monitoring and Mitigation Plan

The NTF reviewed the sections of the WGWAP website that were relevant to seismic surveys. In particular it recalled that in the past the Panel had suggested the 2010 Monitoring and Mitigation Plan be given a distinct place on the website and that the statement made on general advice for seismic surveys being carried out off Sakhalin (including advice on exclusion zones in Sakhalin) be given prominence.

In conjunction with Kjellqvist, the NTF revised the segment of the site related to seismic surveys[2]. Kvellquist will ensure that the section can be easily found from other pages. The NTF also highlighted the need to ensure that links to documents remain consistent (e.g. using permalinks) if their position moves.

2.6 WGWAP-11 (Item 5.2.5): IUCN progress report on obtaining information from other companies

The importance of obtaining information from other companies to assist the Panel's work has been identified as an important issue since the inception of the Panel. At NTF-1 it had been agreed that the issue of obtaining and reviewing data on seismic surveys from other companies would require a more focussed and consistent effort by IUCN than has occurred thus far. It hoped that the appointment of the new full-time officer, along with the contacts with Rosneft made by Tsidulko and Reeves, would improve the situation.

Saksina reported that there has been only limited progress. IUCN has attempted to connect with companies and the Russian government. They are preparing a letter to the Minister of Environment whom they hope to meet. They invited Gazprom and Rosneft to the WGWAP-12 meeting but have not had any responses. It is possible but unlikely that representatives will attend. She thanked Vladimirov for providing information on useful contacts. IUCN believes they need to meet the companies face to face. Saksina, Reeves and Carl Gustaf Lundin (IUCN's Director of Global Marine and Polar Programme) are planning a trip to Moscow.

Saksina noted that a compilation of information obtained from secondary sources (similar to that presented at WGWAP-11) will be presented at WGWAP-12. WWF has also requested to provided an update if the Panel permits.

2.7 General consideration of Task Force recommendations to improve matters in the future

As noted under Items 2.2 and 2.3, the Chair had expressed concern that two recommendations that had been developed and agreed by the Task Force members (both from the Panel and the Company) and endorsed by the WGWAP had been rejected by the Company in their response to the WGWAP report. The NTF concluded that in both cases, the Company's response had been a result of misunderstanding, miscommunication and/or less careful drafting than required, even though that wording had been agreed by all members of the NTF (and subsequently endorsed by the Panel). It has now drafted new consolidated recommendations that fulfil the objectives of the original recommendations but omit problematical wording. If adopted by the Panel, these will supersede the WGWAP-11 recommendations and enable the Company to make a favourable response.

There was considerable discussion of the general implications of this matter, reflecting the desire of all to try to avoid this happening in the future. Primarily this aim can be achieved by great care being taken by the Company members of Task Forces, as well as Panel members, to try to ensure that issues known to have been problematic in the past (e.g. related to data ownership or references to contractors rather than the Company itself) are avoided during the drafting process.

---

[2] http://www.iucn.org/wgwap/wgwap/seismic_survey_monitoring_and_mitigation_plan/

The NTF noted that a key principle of the WGWAP process (contained in its Terms of Reference) is that the Company will implement 'reasonable recommendations' of the Panel and will 'clearly identify and document the specific areas and points where (i) they were/will be accepted and/or (ii) they were not/will not be accepted and/or implemented, including a clear explanation'.

As a result of these discussions, the NTF adopted the recommendation below which it proposes to the Panel.

Recommendation with respect to Task Force recommendations and responses by the Company
Objective Task Force recommendations are agreed by all members (Panel and Company alike) and recommended to the Panel. Every effort must be made to ensure that these are not rejected by the Company. In the unlikely event that they are rejected, this recommendation also provides a clear mechanism to allow difficulties to be addressed as soon as possible. **Approach** Great care must be taken by Task Forces in drafting recommendations to ensure that if rejection occurs it is not due to legal or administrative problems with drafting. Task Force recommendations that are adopted without change by the Panel will be clearly identified in the Panel's report. If despite this, the Company decides to reject such a recommendation, notification of the rejection should occur in a separate e-mail message from the Company to IUCN, along with a clear explanation of the rationale. IUCN should immediately bring this to the attention of the WGWAP Chair and, where appropriate, the relevant Task Force chair(s) to enable prompt follow-up action to try to remedy the situation as soon as possible. **Responsible Party/Parties** Task Force members, the Company, IUCN **Timeline** If a recommendation is to be rejected, in whole or in part, the Company will notify IUCN as soon as possible and IUCN will contact the Chair of the Panel.

3 2-D SEISMIC (GEOTECHNICAL) SURVEY 2012

3.1 Overview report on conduct of survey by SEIC

The Company provided a PowerPoint presentation on the execution and some preliminary results of the Monitoring and Mitigation Programme (MMP) for the 2012 2D Seismic Survey. In accordance with recommendation WGWAP-11/009, the activities included:

- model-based sound footprint estimation for a 3 x 60 in^3 airgun array in the surveyed area;
- archival acoustic monitoring during the seismic survey (including pre- and post-monitoring);
- real-time behavioural monitoring during the seismic survey (including pre- and post-monitoring);
- marine mammal observer sightings on-board the seismic vessel.

The acoustic modelling undertaken by JASCO found that 'neither site survey should expose to 156 dB re $1\mu Pa^2$-s per-pulse SEL any whales within the 95-percentile distribution boundary by a margin of at least 4 kilometres'.

Archival monitoring was conducted by Pacific Oceanological Institute (POI). Two autonomous underwater acoustic recorders were deployed on 14 June and successfully retrieved on the 10 August. The maximum registered noise levels during the seismic survey at Piltun-20 and Piltun-10 locations did not exceed: SPL_{peak} - 157 and 142 dB re 1μPa; SPL_{rms}- 146 and 134 dB re 1μPa and SEL - 140 and 125 dB re $1\mu Pa^2$-s. These results confirm one of the key finding of the JASCO modelling report i.e. that that the per-pulse sound level is down to approximately 140 dB re 1μPa^2-s at the 95-percentile boundary of the grey whale distribution, while the 120 dB re 1μPa^2-s contour extends essentially to the coastline.

Real-time behaviour monitoring started on the 12 July with pre-monitoring, continued from 21 June until 8 July during the active component of the seismic survey and finished on 15 July with post-monitoring. The dataset included 74 scans and 36 tracks of gray whales. The Company noted that their preliminary impression was that no major changes in gray whale distribution or behaviour occurred.

Four experienced MMOs were contracted through Sakhalin State University and were present on the seismic vessel. Two MMOs were on duty at any time during the work or movement of the seismic vessel. There were six sightings of marine mammals (including two common minke whales but no gray whales) in total during 17 days of seismic survey. One shutdown occurred on 30 June when a common minke whale was found close to the vessel (within the exclusion zone). The weather was generally good.

The presentation concluded that the MMP had been implemented fully in compliance with NTF/WGWAP Recommendations. The seismic survey had started on 21 June and was completed on the 8 July, well before the arrival of the majority of gray whales in the Piltun Feeding thus meeting the primary mitigation measure of completing the survey as soon as possible and before the number of gray whales was high (the Panel had recommended prior to 15 July). The maximum registered noise levels were within the model-based sound footprint estimations. Preliminary information suggested no significant changes in gray whale behaviour or distribution.

In discussion, a number of additional details were clarified:

- for the acoustic data, the Company had deployed two buoys and it also had access to data from ENL buoys for the relevant time period;
- with respect to the shutdown, the animal was first seen at 12:15 and the shutdown occurred at 12:17 - during about an hour of observations it was sighted twice, the second time moving away from the vessel and ramp-up began some 20 minutes later.

3.2 Analytical plans/results

The NTF thanked the Company for this information on the recent survey and for the great efforts made to follow the MMP. It **agreed** that it would be valuable for a written document or documents to be prepared summarising the different components of the work undertaken, including information on shut downs (including due to bad weather), times when the survey operated under reduced visibility, protocols used by the behavioural team etc.

The Company noted that this work was underway. It was expected that the acoustic report will be completed by the end of 2012 and the behavioural report by the end of February 2013. More comprehensive reports incorporating integrated analyses of the various datasets collected during the MMP as well as other relevant data (e.g. from the joint programme, the telemetry programme) are anticipated and a workplan is being developed. It is hoped that this might be available by the end of 2013.

There was some discussion about the contribution of the ‘boomers’ to the noise energy input to the environment during the survey. The boomers were important for smaller parts of the survey area that required higher resolution. This had been discussed during NTF-2. It had been assumed that the contribution to noise levels from these low to medium frequency, downward directional devices would be dominated by that of the airguns. This had been confirmed by analyses made by JASCO.

However, the NTF noted that there was some uncertainty about (a) the equipment that was used and (b) the time at which it was used and whether it was active at the same time as the airguns. Vladimirov confirmed that it was not possible to answer these questions during the workshop but that the information should be available from the contractor. The NTF **agreed** that it was important to obtain this information and to analyse the acoustic data to confirm that the use of this equipment did not substantially increase noise within the feeding area.

Nowacek noted there is a need for a full analysis of the acoustic data and a first step is to examine the acoustic data in the context of the scan data. This does not necessarily require a full MVA or a per pulse analysis but there is a need to understand the total received energy.

Vladimirov noted the need for a balance between work on the analysis of the results of the 2012 survey (with its much lowers sound source than the 4D survey) with completing work on the 4D analyses and planning for future surveys (see Item 6). Resources and people are a limiting factor. He believed that as the impact of the 2D was not significant a high level of analysis is not needed. The Company plan to look at noise footprints and whale positions and if the footprint is below the threshold level assumed to result in a behavioural reaction then further consideration is unnecessary.

The Chair recalled the need to consider the objectives of analysing these data as discussed at several previous meetings. Data on the effects of sound on grey whales is very limited and based on a single report of low sample size (the fact that the study was conducted some time ago is completely irrelevant). When developing the MMPs for the 2010and 2012 surveys it had been noted that the basis for two assumed thresholds were not hard and fast and there was an ongoing need to obtain additional data on responses at different levels to improve future mitigation efforts. The rationale behind the data collection for the 2D survey was that it may provide insights on the behavioural threshold in particular. It is important that the data are at least examined to determine if they are sufficient to warrant further analyses. Nowacek added that the field is moving away from the concept of a step function response.

Gailey, Broker, Nowacek and Racca provided a practical suggestion for initial analyses of the behavioural data. During the 2D seismic survey in 2012, behavioural observations yielded a total of 72 scans, 36 tracks (14 pre, 15 during, 7 post seismic), and focal follows collected pre-, during, and post seismic activity. To provide a preliminary understanding of these data in relation to the seismic survey, several basic exploratory plots are suggested.

For abundance/distribution scan sampling data, overall and pre/during/post seismic geographic plots should be generated illustrating the gray whale locations and the 90th, 75th, and 50th kernel distributions. The mean number of whales and pods per scan should be plotted as a function of date and in relation to periods of seismic activity. Cumulative sound levels should be estimated for the preceding 2hr and 3days at the 10m acoustic buoy location directly offshore of the behavioural observation location and the number of whales per scan compared in relation to higher/medium/lower sound estimates as well as pre/during/post abundance estimates.

For movement analyses, geographic plots illustrating all theodolite geographic positions recorded overlaid with the resampled 1.5 minute geographic locations should be conducted for each gray whale track. The estimated received sound energy levels should be illustrated in these figures along with a colour scheme of the gray whale speed on the resampled trackline. In addition, the geographic display should include the seismic block and overall 156 db SEL acoustic footprint at maximum exposure when seismic activity was being conducted. Descriptive information on group size, confidence estimate, subject under observation, date/time of observation, duration of the track, and observed behavioural states should accompany each figure. These figures should attempt to be comparable to the noise case files generated for the 4D seismic survey (see the NTF2 report).

In addition to these plots, several movement variables should be calculated based on the 1.5 minute resampled tracklines and binned into 10.5 minutes intervals for each track. The movement variables should be speed (km/hr), distance to shore (km), reorientation rate (degrees/min) and linearity/mean vector length. Scatterplots should be generated illustrating the received sound levels and estimated movement variables. For behavioural state observations, one randomly selected bin for each behavioural state in a trackline should be selected and box plots generated to illustrate differences in these movement parameters.

For dive-surface-respiration information collected, the respiration interval, dive time, surface time, surface blow rate, and dive-surface blow rate should be calculated for each 10.5 minute interval. Scatterplots for each respiration parameter should illustrate its association with the estimated received sound energy level.

For behavioural state observations, one randomly selected bin for each behavioural state in a focal follow should be selected and box plots generated to illustrate differences in these respiration parameters.

These plots will provide a basic understanding of the behavioural information obtained during the 2D seismic survey. This recommendation depends on availability of behavioural data and may need to be revised if data prove to be unavailable.

These details are referred to in the recommendation given under Item 3.3 below.

3.3 Conclusions and recommendations

The NTF welcomed the preliminary information provided by the Company and looked forward to receiving detailed written reports. It congratulated the Company on the efforts that had been put into following the recommendations of the NTF and the Panel with respect to the conduct of the survey and the MMP.

It also developed two recommendations for future analyses of the acoustic and the behavioural data. These are given below. With respect to these analyses, the NTF **agreed** that it was important that they be carried out by scientists familiar with the existing time-series of data. The NTF was also informed that the acoustic data for the 2012 survey will be supplied to it in the agreed format for pulse noise detailed in the consolidated recommendation to replace WGWAP-7/002 (see above).

Recommendation to perform additional acoustic analysis of the 2012 South Piltun 2D survey with respect to the non-airgun low frequency sources
Objective
To determine whether non-airgun low frequency geoacoustic sources have similar acoustic characteristics (e.g., level, frequency spectrum) and thus could have had impacts similar to those of airguns.
Data requirements/analyses
Obtain from the survey operators, to the extent possible, information about (a) which specific equipment was used; (b) time periods when low-frequency geoacoustic sources other than the airgun array were being used; and (c) source vessel navigation data for those periods.
Assuming these data are available, perform analysis of individual pulses with the same method used for the airgun source and report pulse levels (peak SPL, rms SPL and per-pulse SEL) as a function of range from the source for a short segment (i.e., one shot line) of signals recorded near the closest point of approach (CPA) for each of the four available recording stations: (i) Moliqpaq; (ii) Piltun-10; (iii) Piltun-20; (iv) Piltun-S
Responsible persons
Sakhalin Energy for ensuring the analyses are carried out, informing NTF members on progress, consulting with them on methods where appropriate and submitting written reports, NTF members for providing verbal and written comment as appropriate through email, teleconferences and meetings, and IUCN for logistical support with document circulation, teleconferences and meetings.
Timeline
This represents a modest amount of work, so the deadline for completion of this task is 31 March 2013

Recommendation to conduct analyses of behavioural observations during the 2D seismic survey in 2012
Objective
To undertake initial analyses of the behavioural observations collected during the 2012 2D seismic survey consistent with previous analyses of similar data to provide an overview of the obtained results. This will enable the NTF to determine whether the data are sufficient to provide information on effects of received noise levels on gray whale behaviour during the survey.

Data requirements/analyses

During the 2D seismic survey in 2012, behavioural observations yielded a total of 72 scans, 34 tracks, and X focal follows collected pre-, during, and post seismic activity.

It is recommended that for abundance/distribution scan sampling data, overall and pre/during/post seismic geographic plots are generated illustrating the gray whale locations and the 90th, 75th, and 50th kernel distributions.

The mean number of whales and pods per scan should be plotted as a function of date and in relation to periods of seismic activity including cumulative sound levels for the preceding 2hr and 3days as recorded at the 10 meter isobath in front of the acoustic station.

For movement analyses, it is recommended that geographic plots be prepared illustrating all theodolite geographic positions for each gray whale track (so-called case studies). The estimated received sound energy levels should be illustrated in these figures along with a colour scheme of the gray whale speed on the trackline. In addition, the geographic display should include the seismic block and overall 156 db SEL acoustic footprint at maximum exposure when seismic activity was being conducted. Descriptive information of group size, confidence estimate, subject under observation, date/time of observation, duration of the track, and observed behavioural states should accompany each figure.

Additionally, several movement variables should be calculated for each track. The movement variables should be speed (km/hr), distance to shore (km), reorientation rate (degrees/min) and linearity/mean vector length. The dive-surface-respiration variables should be respiration interval, dive time, surface time, surface blow rate, and dive-surface blow rate. The effect of sound energy levels and behaviour state on these behavioural variables should be analysed using the same methodologies was done during the 2010 4D survey.

More details of these analyses are outlined in section 3.2 of the NTF 3 report.

Responsible persons

Sakhalin Energy (for ensuring the analyses are carried out, informing NTF members on progress, consulting with them on methods where appropriate and submitting written reports), NTF members (for providing verbal and written comment as appropriate through email, teleconferences and meetings) and IUCN (for logistical support with document circulation, teleconferences and meetings).

Timeline

A written report containing all of the plots, description of methods, and analytical results should be computed in time for presentation at NTF-4.

4 PROGRESS REPORT ON SOUTH PILTUN PROJECT WITH RESPECT TO NOISE

4.1 Presentation by SEIC

Sakhalin Energy provided an overview of the 2012 Site Survey. The purpose of this survey was to identify the bottom features and potential hazardous shallow gas deposits in shallow geological formations (depth less than 500m into the sea bed) and to assess the ability of the sea floor to support structures. The review covered:

- HR/UHR seismic survey operations from RV *Zephyr-1* (19 June to 19 July including transit);
- Analogue seabed survey operations from RV *Zephyr-1* (12 July to 7 August including transit);
- Geotechnical survey operations from MV *Mariner* (16 August to 16 September including transit).

The results of the survey feed into the results of Sakhalin Energy’s ongoing studies to potentially develop untapped oil and gas accumulations in the South Piltun structure located in Sakhalin Energy’s Piltun-Astokhskoye license area. This information is essential if the option of a PA-C platform is to be confirmed as technically feasible. It is also required to be produced under Russian Federation law.

Highlights from the presentation indicated that the site survey (2D high resolution seismic) operations were completed before the WGWAP desired date of 15 July 2012 (see Item and Geotechnical operations were completed before the storm season begins at the end of September. There were no HSE incidents during these surveys.

The preliminary results indicate that from the two possible locations for the 3rd PA-C platform the site most distant from shore is more appropriate with respect to environmental and drilling considerations. These findings will be presented at a Shareholder Workshop to be held at the end of November, 2012 in Sakhalin. Depending on the Selection Workshop's outcome on whether to continue with the project and with associated activities, the South Piltun Project will move on to the next Decision Gate in 2013.

4.2 Conclusions and recommendations

The NTF thanked Vladimirov for this presentation. The timeline for future decision making was clarified as follows:

A selection workshop will take place at the end of November that will review the results of the above work and in particular the conclusion of a more offshore site should the development go ahead. The decision as to whether to proceed with the development or not will take place sometime in 2013. If it is agreed to proceed then the next step would be drilling of an appraisal well in around 2014. The presentation to WGWAP will provide more details of the overall process. Donaghy noted that the environmental impact assessment is expected to be completed in the next few weeks.

The Company will inform the NTF and the Panel as soon as possible in order to allow it to develop plans to examine the acoustic implications of any appraisal work.

5 CUMULATIVE IMPACTS

5.1 Update on recent work

Last year, the NTF had noted the importance of considering cumulative impacts of anthropogenic activities including noise on populations. It recognised that this important work was still in its infancy and had agreed that it would like to be kept informed of future developments in this area. There had been some discussion of terminology. Cumulative implies build up over time and is generally used in the context of population level effects. However, the term is often used to refer to exposure to multiple signals at the same time when in fact 'aggregate' seems more appropriate for the latter.

This year, the NTF received brief updates on progress with respect to the initiatives considered last year. Nowacek reported that the PCoD (Population Consequences of Disturbance) work is focussing on three species – elephant seal, bottlenose dolphin and North Atlantic right whale. Although work is progressing there are as yet no formal publications. However, there have been some conference abstracts and the right whale work will be summarised at the meeting of the North Atlantic Right Whale Consortium meeting later this month.

The 'Cetsound' (Sound and Cetaceans) project is examining exposure to noise for wide range of species over the geographic range of the United States' exclusive economic zone (EEZ). Racca noted that since NTF-2 a public workshop had been held by NOAA in Washington DC to present and discuss the results of the project, and a web site has been created to give access to much of the information. A methods paper is being completed for broad scale modelling and sound mapping over large areas with distributed sound sources such as shipping. He also referred to a recent paper by Erbe, McGillivray and Williams (Erbe *et al.*, 2012)[3] which examined sound in the Vancouver Bay area in the context of a forthcoming pipeline development. Reference was also made to work being undertaken at St Andrews on analytical approaches to aid in interpretation of data from experimental exposures with an emphasis on moving from step functions to dose response curves. Finally, he commented that the University of California, San Diego group that is sponsored by BP working on cumulative effects is preparing a paper for Conservation Biology.

Cooke reported on further development of the Potential Cumulative Impact (PCI) index that is designed to extend the PBR concept (which covers direct mortalities and is incorporated into law and policy in the US and some other countries) to cover sub-lethal effects and indirect mortalities. The concept was originally developed at the 2009 Asilomar workshop on Cumulative Impacts (Wright *et al*., 2009). Cooke presented a quantitiative approach to determining the PCI to the December 2011 Marine Mammal Conference in Tampa, Florida.

Vladimirov briefly reported on Moscow University's work on integrated analysis of data collected from 2004-11, reported previously to the Panel. Progress has been much slower than anticipated reflecting the difficulties of integrating the different data sources, particularly with respect to noise. A full report will be given to WGWAP-12. He noted that other operators are increasing their activity on the Sakhalin shelf, making the issue of cumulative effects increasingly important.

Broker informed the NTF that relevant work was being undertaken on the issue of cumulative effects on several species (and subsistence hunts for narwhals) with respect to oil and gas development by three companies off West Greenland.

5.2 Conclusion and recommendation

The NTF reiterated the increasing importance of this subject to its work and its ability to provide advice on anthropogenic noise effects off Sakhalin, whilst recognising the analytical complexities involved. It **agrees** that this should become a standing item on its agenda and that sufficient time should be allocated for a fuller discussion at its next meeting. To facilitate this it developed the recommendation below.

Recommendation to assist consideration of cumulative effects of anthropogenic activities off Sakhalin
Objective To develop an agreed definition of 'cumulative effects' and related concepts for consideration at the next meeting of the Task Force and to obtain relevant published and 'grey' literature on the topic from other areas that will assist in such considerations. **Responsible persons** Southall and Vedenev will co-ordinate the development of the definitions, recognising the different concepts present in the literature. IUCN will co-ordinate with NTF members on collecting relevant published and grey literature including information on the work off West Greenland. **Timeline** The draft definitions will be submitted to the Task Force for comments by 31 January 2013. IUCN will collect the appropriate literature and make this available to Panel members at least one month before the next NTF meeting.

[3] http://asadl.org/jasa/resource/1/jasman/v132/i5/pEL423_s1?bypassSSO=1

6 4-D ANALYSES

As the NTF and Panel have noted on several occasions, considerable effort and resources were expended by the Company and the Panel to design a comprehensive monitoring and mitigation programme for the 2010 4D survey. Similarly considerable effort and resources were expended in successfully implementing the programme in the field – an effort perhaps unparalleled in the world. The NTF reiterated at NTF-2 that it would be false economy not to complete full analyses of the resultant data. The relatively slow progress was not a criticism of the analysts but a reflection of the complexity of validating and preparing the data, determining appropriate metrics for key parameters and developing new integrative analytical methods. NTF2 had welcomed the progress made to date, made suggestions and recommendations for improvements and looked forward to receiving the results.

6.1 Report by SEIC on analyses recommended at previous meetings (NTF-1, NTF-2, WGWAP-10 and WGWAP-11)

6.1.1 Noise cases

NTF2 had recognised the value of the noise cases presented at the last meeting that illustrated whale tracks and estimated received sound levels. It had made a number of suggestions for future work including:

- giving priority to cases that include ramp-up and the start of full scale exposures;
- including loud impulse noise and nearby continuous noise from vessel presence data in the final analysis;
- assessing explicitly at least for a subset of the tracks the effect of using maximum over depth values versus a median value of the water column for estimated received levels;
- presentational improvements regarding the depiction of the geospatial relations between whale, seismic vessel, and other ships.

Racca reported on progress made in the estimation of noise levels at tracked whale positions for the behavioural multivariate analyses MVA. The per-pulse SEL estimates obtained by numerical modelling in 1-minute steps are now adjusted by the difference between the model estimate at the PML sensor nearest to the whale location and the corresponding measured level derived from the pulses received over a 1-minute period. The average absolute correction over the roughly 2500 1-minute estimated levels on whale tracks for active seismic survey periods was just over 3dB. This is consistent with the estimation tolerance that was maintained during the survey monitoring and mitigation period through the process of start-of-line model case selection and ongoing real-time verification as each line was acquired. It has been possible to track the ramp up, correcting the previous assumption of a linear progression. In practice ramp-ups may have been non-linear and occasionally discontinuous so the actual data is an evident improvement.

The NTF thanked Racca for this update. It reiterated the value of these individual noise cases as a complementary source of information to those provided by MVAs. The question of publication is considered under Item 6.3.

6.1.2 Behaviour MVA

Gailey presented results of the behavioural MVA for the 4D seismic survey. The behavioural MVA was designed to examine both natural and anthropogenic associations with movement and respiration data collected during the 4D seismic activity in 2010. The overall null hypothesis of these analyses was that behavioural activity of the western gray whale population was not significantly affected by continuous and/or pulse sound and/or vessel proximity/presence during the 4D seismic activity. The behavioural dataset consisted of 59 whale tracks that yielded 395 bins of 10.5 minute durations and 36 focal follows (214 bins). Gailey illustrated the pre-modelling relationships of the response variables, natural explanatory variables, and the sound and non-sound potential impact variables and presented rationales for inclusion/exclusion of response and explanatory variables. Gailey also presented the analytical issues of autocorrelation and pseudo-replication and demonstrated how weighting and the mixed linear models helped to alleviate these analytical issues.

The movement models found similar natural associations to previous analyses (Gailey *et al.*, 2001, Gailey *et al*., 2007, Gailey *et al*., 2011) and relationships between western gray whale relative orientation in relation to the closest vessel of approach. The relative orientation association with the closest vessel suggested that as the closest vessel was within 12 km, a gray whale tended to orient perpendicular to the vessel. As the vessel moved away from the whale, the gray oriented away from the vessel. The surface-respiration-dive models found depth to be significantly associated with dive time and number of blows per surfacing and as the number of vessels with 5 km increased the dive-surface-blow rate increased.

Gailey compared behavioural models for the 4D seismic survey to previous behavioural models conducted on concrete gravity based structure and pipeline installation activities. The 2010 behavioural models had similar variables that entered and similar coefficients to previous behavioural MVAs. The behavioural models went further to explore several analytical issues, such as use of Akaike Information Criterion (AIC) or Bayesian Information Criterion, exclusion of behavioural state as an explanatory variable, and power analyses. These explorations increased the robustness of the results and placed the results in context of their ability to detect an affect if one existed.

Of particular interest was a preliminary power analysis where the initial results suggested that with an effect size of 1.5% increase in speed per 1 db increase in the maximum peak sound pressure level (which some may consider a relatively large effect) that this study with a sample size of 59 would have a 27% chance to detect this level of an effect. A larger sample size of 242 tracks would be needed to have an 80% probability of detecting the above effect size.

In summary, the behavioural multivariate analyses were unable to associate significant behavioural changes in relation to sound generated by seismic or vessel activity. These results may suggest that there were no large population level behavioural reactions to the activity. Although some individuals were noted to respond to sound (i.e. noise case files, see Item 6.1.1), these analyses assessed population level affect and not individual level affect. These findings could have been a result of reducing level of sound exposure due to an effective mitigation/monitoring design and implementation.

In response to a query, Gailey noted that the small mother-calf sample size (n=2) precluded incorporation of ‘subject’ as a variable. He also stressed that the analysis was not intended to evaluate harmful versus non harmful responses; that is the subject of initiatives such as PCoD (see Item 5).

The NTF thanked Gailey and co-authors for their work. It discussed the study's power analyses and suggested that a number of effect sizes should be examined as well as a range of response variables. Of course the power of the study relates to testing the null hypothesis. Although not simple to develop, alternative hypotheses might have enhanced power to accept/reject hypothesis based on assumptions of the level of response that could be expected.

With regard to the initial power analysis, it was unclear what a coefficient of 1.5% per dB implied in terms of the actual seismic-related change in mean whale speed, because this depended on the range of dB over which the model is fitted. The model assumes a linear relationship with dB whereas in reality it is likely that most of the effect occurs at higher dB levels.

The NTF also noted that a uniform increase in speed is not necessarily the kind of response that would be expected. A marked response by some whales might be more likely than a moderate response by all whales. As noted at NTF-2, some individual whale tracks did seem to show a marked response.

A recommendation addressing this issue is given under Item 6.1.4.

More generally, the TF emphasized that non-rejection of a null hypothesis of no effect was not in itself an indication that there was no effect. Attention needs to be paid to the formulation of alternative hypotheses that involve plausible models of possible effects. Rejection of some or all alternative hypotheses would be a more informative result than mere non-rejection of the null hypothesis.

If there were reasonable models of responses available in the literature that could be used as alternative hypotheses, it should be a relatively straightforward task to determine whether these could be rejected by the current dataset. Unfortunately, the field is not yet at this stage: alternative hypotheses need to be constructed from scratch. This is a non-trivial exercise, because alternative hypotheses will need to allow for responses beyond the immediate, such as a tendency for some whales to leave the area when the survey starts, while those remaining might progressively habituate to the sound.

A recommendation addressing this issue is given under Item 6.1.4.

6.1.3 Distance-to-shore MVA, density MVA and distributional MVA.

DISTANCE – TO –SHORE MVA

Koen Broker provided a verbal presentation on the results of the distance-to-shore MVA on the behalf of Judy E. Muir and Laurie M. Ainsworth, who couldn't attend the meeting.

The analysis investigated possible effects of the 4-D seismic survey sound on the distribution of western gray whales (WGWs), specifically whale distance from shore, in the nearshore Piltun feeding area.

Scan surveys to monitor distribution and abundance of WGWs were conducted from onshore observation stations prior, during and after the seismic survey. Details of the distribution and behaviour scan survey protocols may be found in Vladimirov et al. (2011) and Gailey et al (2011) respectively.

As presented at the NTF-2 meeting in February 2012, a linear mixed effects model framework was used that allowed the inclusion of both fixed and random effects. The model was first developed on gray whale sighting distances to shore. The model was then refit using sighting distances to individual gray whales as a sensitivity test. A second sensitivity test using the distance correction factor presented at the NTF-1 meeting in November 2011 was also conducted on both sightings and individual whales. The sighting locations were recalculated using the distance correction factor presented at the NTF-1 meeting in November 2011, and sighting and whale distances to shore were recalculated. The model was refit to each corrected data set and results were compared with the non-corrected sightings.

Six median over depth cSEL sound covariates were selected for model development. These covariates represented combinations of two virtual whale locations (500 m and 5000 m) and three sound accumulations periods of 8 hours, 3 days and since seismic survey start. Including these data without an indicator for the zero class could give misleading results. Thus, a sound on/off indicator was included in the models. The historical data exploratory data analysis showed that decreasing visibility, increasing swell height and winds from the north-northwest direction adversely affected sighting distances from a station. Tide was not found to have an effect on sighting distance from shore. A small, but consistent, diurnal effect in whale distance from shore was found whereby whales moved inshore as the time of day increased. There was also an effect of station on distance from shore. Both the mean distance to shore and the variability in distance to shore changed across stations.

Numerous types of confounding were found in the seismic data due to the limited survey period. Both visibility and tide height were confounded with time of day, and there was a confounding of wind direction with visibility code. There was also a confounding of time of day with survey effort at the northern distribution stations because scans were only conducted once per day at these stations (weather permitting), and were scanned in order beginning either at station 1 or station 8. Consequently data from the northern distribution stations were not included in the analysis.

Time of day and visibility were important covariates and were retained in all models. Initial model fitting on the uncorrected sightings distance to shore response suggested that the best model included visibility, time of day, and an interaction between on/off-8 hour and time of day. In looking at the interaction effect we discovered that the time by on/off interaction was related to differences in the seismic effect at station 10. Whales appear to move further from shore through the day at stations 9, 12, 13 and both behaviour stations when 8 hour seismic sound was "on" but, this effect is reversed for station 10 and 11 i.e., there were shorter sighting distances to shore when the on/off 8 hr was non-zero. This reversal was strong at station 10 and marginal at station 11. Therefore a term was added to the model to allow the seismic activity effect to differ for station 10. The final model included visibility, time of day, on/off 8 hour, the indicator for station 10, and an interaction between station 10 and on/off 8 hours. A model with the 3 day on/off covariate was also found to be significant; this covariate is almost identical to the 8 hour on/off with different values only for 3 scans.

All sensitivity tests selected models consistent with the uncorrected sightings model. The sensitivity test for individual (uncorrected) whales resulted in very similar effects. The visibility effect increased and the on/off effect decreased for the corrected models. In particular, there was no longer an effect of on/off sound at the behaviour stations.

It appears that western gray whale distance to shore generally increased slightly (about 100 to 200 m) in the presence of seismic sound at both the 8 hour and 3 day accumulation periods. If we include a time by sound interaction in the model, the difference increases to approximately 500m. The finding that there was a slight reversal of this effect at station 11 and a strong reversal at station 10 requires further investigation. There does not appear to be substantial differences in detection covariates, survey effort or timing of scans at stations 10 and 11 compared to the nearby behaviour stations where comparable levels of sound were present. However, station 10 tended to have good visibility during the seismic off periods. Another possible explanation may be that there was a low number of "off" sightings at station 10 (n=8) and these sightings were further from shore compared to "off" sightings at the other stations.

DENSITY MVA

An overview on the status of the density MVA was provided by Koen Broker, on behalf of Judy E. Muir and Laurie M. Ainsworth who did not attend the NTF meeting. This analysis uses WGW density surfaces of average estimated densities at a 1km x 1 km resolution to assess effects of seismic sound.

At the second NTF meeting a preliminary model was presented that used densities averaged over multiday periods throughout the pre-seismic, seismic and post-seismic monitoring periods. This temporal blocking was needed to provide both complete survey coverage of the Piltun feeding area and address the issue of very low non-zero data, due to the low numbers of whales in the area. Discussion at the NTF-2 meeting resulted in recommendation to analyse densities at the individual scan level. Based on this recommendation the methods were revisited. These updated proposed methods were sent to the panel for review in September. This proposal suggested that:

- Exploratory data analysis be conducted to assess minimum level of temporal and spatial blocking that would meet analytical requirements (map coverage, # non-zero cells);
- Exclusion of pre-seismic period that was driving large temporal blocking;
- Use of Functional Data Analysis to incorporate the seismic sound covariates.

The NTF provided extensive comments to this proposal and based on this feedback it was agreed to remove the idea of spatial blocking. Instead it was decided to explore different scales of temporal blocking.

An exploratory data analysis was conducted to assess these different time periods for temporal blocking of average densities in the south part of the Piltun feeding area. The objective was to determine the minimal block of time that would meet the criteria of 1) providing complete survey effort throughout the "map", and 2) at least 25 non-zero grid cells within a time interval. The pre-seismic surveys were excluded from this exploratory analysis because the low number of gray whales present during this monitoring period required multiday blocks to provide the needed number of non-zero grid cells in a time period.

An assessment was made of the Individual surveys[4] of the five southern distribution surveys that were completed within two hours and timed to be synchronized with the shooting of a line and turning time

[4] A "survey" in the context of this exploratory analysis refers to a set of scans across the five southern distribution stations (9-13)

between the lines. Approximate 2/3 of the surveys provided complete coverage of the survey area. Incomplete surveys were caused by one or more scans at a station not being conducted because environmental conditions at that station did not meet survey protocols for visibility or sea state, or insufficient time to keep surveys synchronized with the seismic shooting.

Behaviour scans were added that overlapped in time with each distribution survey's duration and reassessed the map coverage and number of non-zero grid cells at the survey level. This improved the map coverage during a survey, but the number of non-zero grid cells per block was still low. Thus the use of densities at the individual scan level as recommended in the NTF-2 report is not feasible due to the lack of coverage of the spatial area of interest (southern stations) and the low numbers of non-zero grid cells at this temporal scale.

The temporal block was then expanded to include pairs of adjacent surveys (that included distribution and behaviour scans) within a survey day. This level of blocking improved both the proportion of blocks that had complete coverage of the map and the number of non-zero cells per block. However, the number of non-zero cells within a block was still low.

Finally, a daily temporal block was used to average distribution and behaviour scans. This level of temporal blocking ensured complete map coverage within each spatial block and substantially increased the number of non-zero grid cells per block. However there were two blocks (June 19 and 23) that still had quite low numbers of non-zero cells, i.e., 6 and 3 cells respectively.

In summary, it is necessary to increase the temporal blocking to at least a daily period to meet the criteria of map coverage and number of non-zero cells if inference about the change in spatial patterns over time has to be made.

Temporal Block	**Number of blocks**	**Percent of blocks that provided complete map coverage**	**Number of non-zero grid cells**			
			Mean	Standard deviation	Minimum	Maximum
Survey (distribution scans only)	47	64	4.6	3.39	0	13
Survey (distribution and behaviour scans)	47	71	6.1	4.05	0	14
Pairs of adjacent surveys (distribution and behaviour scans)	28	79	9.1	6.45	0	21
Daily (distribution and behaviour scans)	12	100	19.9	10.14	3	36

Table 1. Summary of temporal blocking exploratory data analysis results

A telecom was held with members of the NTF, Judy Muir and Laurie M. Ainsworth to discuss the proposed way forward on temporal blocking. It was agreed that sensitivity analyses would be conducted to determine how this blocking affects the results.

Furthermore it was proposed to use functional data analysis (FDA) to incorporate the seismic sound covariates into the density MVA. FDA uses smoothing techniques to filter out noise and allow better interpretation of complex data. It also address the concerns regarding using means or medians to summarize seismic sound covariates because the sparseness of map coverage and non-zero data at the survey level necessitates averaging densities over at least a daily time interval. Use of daily blocks means that there will be multiple survey midpoint times within each temporal block. Therefore a decision as to where in the time interval to place the end point of the seismic sound time series is yet to be decided with the NTF.

The Densities MVA model structure presented at the NTF-2 meeting will be used to complete the analysis.

Furthermore it was proposed to use functional data analysis (FDA) to incorporate the seismic sound covariates into the density MVA. FDA uses smoothing techniques to filter out noise and allow better interpretation of complex data. It also address the concerns regarding using means or medians to summarize seismic sound covariates because the sparseness of map coverage and non-zero data at the survey level necessitates averaging densities over at least a daily time interval. Use of daily blocks means that there will be multiple survey midpoint times within each temporal block. Therefore a recommendation as to where in the time interval to place the end point of the seismic sound time series is yet to be made with the NTF.

6.1.4 Conclusions and recommendations

The NTF noted the relationship between the MVAs that examine ‘aggregate’ responses and the noise cases that detail individual responses. Both are important components of understanding the effects of noise. The NTF encourages publication of the noise cases and welcomed information from Broker that the intention was still to publish a series of papers, ideally together although this will depend on completion of the various MVAs (see below) that are at different stages of development. The NTF **encourages** publication of these papers, including the noise cases, as soon as possible.

The NTF also **agreed** that any presentations or conference publications related to analyses of data from the 4D survey should be sent Saksina for circulation to the NTF and Panel by IUCN.

With respect to the noise case studies, the NTF **welcomes** the additional work undertaken by Racca and reiterates the other suggestions made at NTF2 in developing the final paper.

With respect to the behavioural MVA, the NTF **welcomes** the work undertaken by Gailey and recognises that this work is almost complete. In terms of assisting the interpretation of the results for the final paper, the NTF proposes the following recommendation.

Recommendation to assist interpretation of the results of the behavioural MVA
Objective Interpreting the results of the behavioural MVA can be assisted by consideration of power analyses. This recommendation suggests which analyses are most valuable **Analyses** Power analyses should be undertaken for each major dependent variable in terms of the power to detect a survey -related shift in the observed distribution of the variable. For example, a 10% upward shift in the speed distribution would mean that the median under exposure is the 60%-ile of the unexposed level. The estimates of power do not need to be precise. In addition the following approach should be explored: (i) define criteria for a marked response; (ii) estimate the power of the data to detect a seismic-related change in the proportion of whales showing a marked response. **Responsible persons** Gailey **Timeline** The work should be undertaken in an expeditious manner and incorporated into the final behavioural MVA paper and submitted to the NTF when completed prior to its next meeting.

In addition, in order to help further developments of methods to assess effects of anthropogenic activities on cetaceans, the NTF developed the following recommendation.

Recommendation on the development of alternative hypotheses for effects of anthropogenic activities
Objective The formulation of alternative hypotheses that involve plausible models of possible effects

Approach
Development of alternative response hypotheses should be undertaken on an exploratory basis. Only when concrete hypotheses are on the table can the feasibility of using available data to reject some or all of them can be examined. This is a generic issue, relevant not only to Sakhalin case and it can best be investigated in a collaborative manner.
Responsible persons
Cooke will develop a short letter explaining the issue and this will be distributed by IUCN to potentially interested scientists to determine their interest in assisting with the development of a set of standard alternative hypotheses. Depending on the replies, Cooke will propose an approach/report to the next meeting of the NTF.

With respect to the distributional MVA, the NTF noted that the power of the data to detect noise-related distributional shifts may be marginal, and **agreed** the following recommendation.

Recommendation on the distributional MVA
Objective
To ensure that the distributional MVA makes maximally efficient use of the distributional data to estimate possible noise-related effects on distribution.
Approach
If analysis methods are used that involve aggregating sightings or densities across space and/or time, care should be taken to ensure that the choice of resolution does not compromise the power of the analysis to detect possible effects of noise. If appropriate, sensitivity to of the results to the choice of spatial and/or temporal resolution should be investigated. If zero-inflated models are used, the appropriate scale for estimating zero-inflation factors should be determined: this will not necessarily coincide with the resolution used for the estimation of effect sizes.
Responsible persons
Muir and co-workers.
Timeline
In time for inclusion in the report of the distributional MVA.

6.2 Future 4-D surveys

6.2.1 6.2.1 SEIC report on potential 3D/4D Seismic Acquisition 2014 -2016

The Company reported that as previously advised to the Panel (WGWAP-11), there is potential for additional seismic surveys to be acquired in the period 2014-2016: one over the Northern acreage Piltun-Astokh and another over the Southern Lunskoye acreage. It focussed on the former in its report.

Sakhalin Energy's Reservoir Management Plan contemplates further 3D/4D seismic acquisition between the years 2014-2016 and tentatively every 3-4 years. This 3D seismic survey, repeated periodically, provides time-lapse or 4D component to enable monitoring of hydrocarbon and water movement over the Piltun & Astokh fields. This builds on work commenced in 2010 with the Astokh 4D acquisition and will be the first 4D survey over the Piltun field. The total survey area will be up to 750km^2. Plans are at present at the formative stage but the Company believed it appropriate to brief the Panel in order to allow sufficient time to develop appropriate mitigation and monitoring measures. Further work is required to firm-up the proposal.

The 2010 and 2012 surveys provide the reference framework for future surveys. Seismic sources on future vessels are likely to be comparable to 2010. However, the Company noted that there is a risk of not being able to complete the survey by mid-July (the primary mitigation measure) if the same vessel type and equipment is used as in 2010. The Company will investigate ways to improve efficiency compared to 2010, e.g. by using 12+ streamers instead of the 6 streamers used in 2010. Deployment of 'state-of-the-art' streamers and a suitable vessel will allow streamers to be towed deeper which will allow the survey to continue acquiring in marginal weather conditions. In addition, appropriate survey design can allow the acquisition of data closer to shore earlier in the season, moving further offshore as the season continues.

6.2.2 Conclusions and recommendations

The NTF has spent considerable time developing the MMPs for the 2010 and 2012 seismic surveys. The proposed surveys for the 2014-16 period should build on the experience gained during the practical implementation of those surveys and the analyses of the results of monitoring. Planning for the new major surveys should begin as soon as practical and follow the agreed steps developed for the 2010 survey, including the examination of distributional data, acoustic modelling and optimal survey design. The Company agreed to provide additional information to allow this process to begin as soon as it becomes available. Sufficient time for the necessary iterative work to finalise an MMP must be allowed, recognising that the 2010 MMP provides an important basis for this work.

7 OTHER BUSINESS INCLUDING COMMENTS ON STATUS OF OUTSTANDING RECOMMENDATIONS

The NTF has again covered a considerable amount of work and a number of important topics remain including: consideration of identified periods of loud noise; general consideration of acoustic data presented each year; completion of analyses of the 2010 and 2012 seismic survey data with special reference to developing MMPs for future surveys. Last year the NTF had emphasised the importance of regular teleconferences but these were not as frequent as they should have been. Once again it requests IUCN to ensure that there are regular teleconferences in order to ensure timely progress on recommendations and the identification of problems as early as possible, and to facilitate the timely submission of documents.

8 ADOPTION OF REPORT

The Chair thanked the participants for frank and constructive discussions. He also thanked the rapporteur and the interpreters for their usual efficiency despite some acoustic difficulties.

Annex A - List of participants

Koen Broker (Sakhalin Energy)
Justin Cooke (WGWAP)
Mike Donaghy (Sakhalin Energy)
Greg Donovan (WGWAP)
Richard Evans (Sakhalin Energy)
Glenn Gailey (Sakhalin Energy)
Doug Nowacek (WGWAP)
Roberto Racca (Sakhalin Energy)
Randall Reeves (WGWAP)
Alexander Rutenko (Sakhalin Energy)
Grigory Tsidulko (WGWAP)
Dave Weller (WGWAP)
Alexander Vedenev (WGWAP)
Alexey Vladimirov (Sakhalin Energy)

IUCN

Tatiana Saksina
Dennis Kjellqvist
Sarah Humphrey

Interpreters

Alexander Danilov
Grigory Shkalikov

Annex B – Agenda

1 INTRODUCTORY ITEMS
- 1.1 Chairman's opening remarks
- 1.2 Available documents
- 1.3 Adoption of Agenda

2 PROGRESS ON GENERAL RECOMMENDATIONS/SUGGESTIONS FROM NTF-2 AND WGWAP-11
- 2.1 WGWAP-11/001: IUCN progress report on dealing with 'continuous' recommendations
- 2.2 WGWAP-11/003: review identified periods of loud noise
- 2.3 WGWAP-11/006: activities document
- 2.4 WGWAP-11/007: improved process for initial analysis of acoustic data
- 2.5 IUCN WGWAP website and Seismic Survey Monitoring and Mitigation Plan
- 2.6 WGWAP-11 (item 5.2.5): IUCN progress report on obtaining information from other companies

3 2-D SEISMIC (GEOTECHNICAL) SURVEY 2012
- 3.1 Overview report on conduct of survey by SEIC
- 3.2 Presentation of data collected by monitoring component
- 3.3 Analytical plans/results
- 3.4 Conclusions and recommendations

4 PROGRESS REPORT ON SOUTH PILTUN PROJECT WITH RESPECT TO NOISE
- 4.1 Presentation by SEIC
- 4.2 Conclusions and recommendations

5 CUMULATIVE IMPACTS

6 4-D ANALYSES
- 6.1 Report by SEIC on analyses recommended at previous meetings (NTF-1, NTF-2, WGWAP-10 and WGWAP-11)
  - *6.1.1 Noise cases*
  - *6.1.2 Behaviour MVA*
  - *6.1.3 Distribution MVA*
- 6.2 Lessons for future 4-D surveys
- 6.3 Conclusions and recommendations

7 OTHER BUSINESS INCLUDING COMMENTS ON STATUS OF OUTSTANDING RECOMMENDATIONS

8 ADOPTION OF REPORT

Annex C – List of Documents

DOCUMENT NUMBER	SUBMITTED BY	TITLE	STATUS
NTF-3/1	IUCN	NTF-3 Agenda (English)	Public
NTF-3/2	Sakhalin Energy	Sakhalin Energy 4-D Seismic Survey Densities MVA Proposal	Confidential
NTF-3/3	Sakhalin Energy	2010 4D Seismic: Survey Western Gray Whale Distance from Shore MVA	Confidential
NTF-3/4	R. Racca	A line in the water - Design and enactment of a closed loop, model based sound level boundary estimation strategy for mitigation of behavioural impacts from a seismic survey	Public
NTF-3/5	G. Gailey	Power analysis for Sakhalin MVA	Confidential
NTF-3/6	A. N. Rutenko	Monitoring the Acoustic Field of Seismic Survey Pulses in the Near-Coastal Zone	Public
NTF-3/7	A. N. Rutenko	Monitoring of Seismoacoustic Signals and Anthropogenic Noise on the Shelf of Sakhalin Island	Public