WESTERN GRAY WHALE ADVISORY PANEL **NTF-4**

NOISE TASK FORCE

REPORT OF THE NOISE TASK FORCE AT ITS 4TH MEETING

11-12 MAY 2013

TOKYO, JAPAN

CONVENED BY THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE

Report of the 4th Meeting of the Noise Task Force

HOTEL OKURA TOKYO, JAPAN, 11-12 MAY 2013

CONTENTS

ACRONYMS

AA	Applied Acoustics
AIS	Automated Information System
ANSI	American National Standards Institute
ASA	Acoustical Society of America
AUAR	Automated Underwater Acoustic Recorder
CE	Cumulative Effect
CGBS	Concrete Gravity Base Structure
CI	Cumulative Impact
Company	Sakhalin Energy Investment Company
CPA	Closest Point of Approach
cSEL	cumulative Sound Exposure Level
EIA	Environmental Impact Assessment
ENL	Exxon Neftegas Limited
ERR	Emergency Rescue and Response
FRC	Fast Rescue Craft (with jet drive)
GPS	Global Positioning System
ID	Identification
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
JPTF	Joint Programme Task Force
LNG	Liquid Natural Gas
MMO	Marine Mammal Observer
MMP	Monitoring and Mitigation Programme
MNR	Russian Ministry Of Natural Resources and Ecology
MVA	Multivariate Analysis
NE	North East
NNE	North-northeast
NOAA	U.S. National Oceanic and Atmospheric Administration
NTF	Noise Task Force
OBC	Ocean Bottom Cable
OBS	Ocean Bottom Sensor
OPF	Oil Processing Facility
OSR	Oil Spill Response
PCoD	Population Consequences of Disturbance
PCI	Potential Cumulative Impact
POI	Pacific Oceanological Institute
PML	Perimeter Monitoring Line
RHIB	Rigid Hull Inflatable Boat
RMS	Root-Mean-Square
SALM	Single Anchor Leg Mooring
SEIC	Sakhalin Energy Investment Company
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSTF	Seismic Survey Task Force
VNIRO	Russian Federal Research Institute of Fishery and Oceanography
WGW	Western Gray Whale
WGWAP	Western Gray Whale Advisory Panel

1 INTRODUCTORY ITEMS

1.1 Chairman's opening remarks

The 4th meeting of the Noise Task Force (hereafter NTF) was held at the Okura Hotel, Tokyo, Japan, from 11-12 May 2013 under the chairmanship of Greg Donovan. The list of participants is given as Annex A.
Donovan suggested that the information provided on the boomer shortly after the conclusion of NTF-3 be added to the NTF-3 report and the revised report be placed on the main website. The NTF **agreed** with this approach.

1.2 Available documents

Previous WGWAP and NTF reports are available on the IUCN WGWAP website[1].

A list of the documents considered by the NTF is given as Annex C.

1.3 Adoption of Agenda

The agenda is given as Annex B.

2 PROGRESS ON GENERAL RECOMMENDATIONS/SUGGESTIONS FROM PREVIOUS MEETINGS

2.1 Recommendation WGWAP-12/001: Task Force recommendations and responses by the Company

Donovan reminded the NTF that in light of this recommendation (which was developed in response to difficulties discussed at NTF-3), care must be taken to ensure that the wording of any recommendations does not lead to their being rejected by the Company because of legal or administrative concerns.

2.2 Joint Programme Task Force report: implications for the Noise Task Force

The Panel established a Joint Programme Task Force (JPTF) under Item 3.5 of WGWAP-12. That meeting was held in Switzerland in February 2013 (WGWAP-13/18).

Two recommendations had noise-related implications and the Company agreed to implement both of these.

2.2.1 Behavioural monitoring (recommendation WGWAP/JPTF-01)

Particularly in the light of forthcoming seismic surveys (see Item 6.2), the JPTF and the Panel had emphasised the need to build capacity for behavioural monitoring to ensure that sufficient expertise was available before surveys took place. The Company reported that behavioural training will be carried out this summer with an initial focus on the use of equipment according to existing protocols. The Company recognises the difficulty of finding experienced behavioural cetacean scientists within Russia to lead the behavioural effort and it will use the forthcoming Society for Marine Mammalogy's biennial meeting in New Zealand to consult with experts in the field.

2.2.2 Use of vessel for photo-identification and biopsy sampling (recommendation WGWAP-JPTF-07)

The NTF spent some time developing an expanded version of the agreed recommendation relating to whether it was appropriate to use a jet-drive fast rescue craft (FRC) for photo-identification and biopsy studies to clarify how it should be implemented.

A small group (Rutenko, Racca, Southall, Vedenev, Vladimirov) was appointed to develop an approach by which to compare and assess the respective noise signatures from an existing rigid hull inflatable boat (RHIB) with a four-stroke outboard engine used by Sakhalin Energy in close approach and photo-ID for western gray whales with a jet-drive FRC that might be used in future operations. The specific objectives were to:

(1) develop a practical, robust protocol for collecting comparable noise signatures of each vessel in a field operation that considers a range of manoeuvres similar to those used in collecting ID photos of gray whales;
(2) agree on the expected nature and format of data that will be reported back to a specified small group as soon as the data are available (expected to be in August 2013);

[1] http://www.iucn.org/wgwap/

(3) develop a practical process to allow the field data collected to be reviewed sufficiently rapidly that an informed assessment of the appropriateness of the use of the FRC (relative to the existing RHIB which is considered acceptable) can be provided in time for application to the remainder of the 2013 field operations.

The NTF thanked the small group for its hard work and accepted the technical details given below. It **commends** the recommendation and technical details to the Panel.

Recommendation on the comparison of the RHIB and FRC
Objective To obtain representative noise signature measurements for the Sakhalin Energy RHIB and FRC jet-drive to determine whether the latter is considered suitable for use (from a noise perspective) in the photo-ID and biopsy work during 2013 and beyond (the RHIB will be the default choice until the noise signature measurements have been collected and reviewed by a small group identified for this purpose.) **Data requirements/analyses** The work falls into two stages: (1) the collection of data from an experiment carried out in which the two vessels undertake speed and course manoeuvres around two deployed mini Automated Underwater Acoustic Recorders (AUARs); and (2) the rapid completion of specific analyses of the results and an assessment of these by a small group who will provide an informed judgement on whether the FRC would be a suitable alternative in terms of potential noise disturbance of gray whales. The technical details of each stage were developed during NTF-4 and are given in the present report. **Responsible persons** Company personnel will be responsible for the collection and analyses of the acoustic data and the circulation of results to the small group (at least Donovan, Nowacek, Racca, Rutenko, Southall, Vedenev, Vladimirov) via the International Union for Conservation of Nature (IUCN). The small group for developing advice on the suitability of the FRC and providing that advice to the Company and the Panel via IUCN within the specified time frame. **Timeline** Collection of data: as soon as possible within the season taking into account practical and permit considerations (expected mid-August). Within 3 days of analysed data being received by the small group, IUCN will organise a conference call to develop advice, which will be transmitted by Donovan (or substitute) to the Company and the Panel.

(A) FIELD DATA COLLECTION METHODS

The specific operational protocol described below for collecting the noise signatures for each vessel will capture a range of operational conditions consistent with the use of vessels around gray whales. It includes portions of vessel operations (consistent 10 knot transit at 100m from fixed hydrophone location) that are consistent with the recent *U.S. ANSI/ASA S12.64 Part 1, Quantities and Procedures for Description and Measurement of Underwater Sound from Ships – Part 1: General Requirements.* In addition it will capture some of the operational manoeuvres (idle, acceleration, turning) that are likely to be important considerations when assessing the relative noise signatures of the two vessels with respect to the disturbance of gray whales. Each of these elements should be replicated around two deployed underwater sound recorders to provide data redundancy in case of loss or malfunction (see Figure 1).

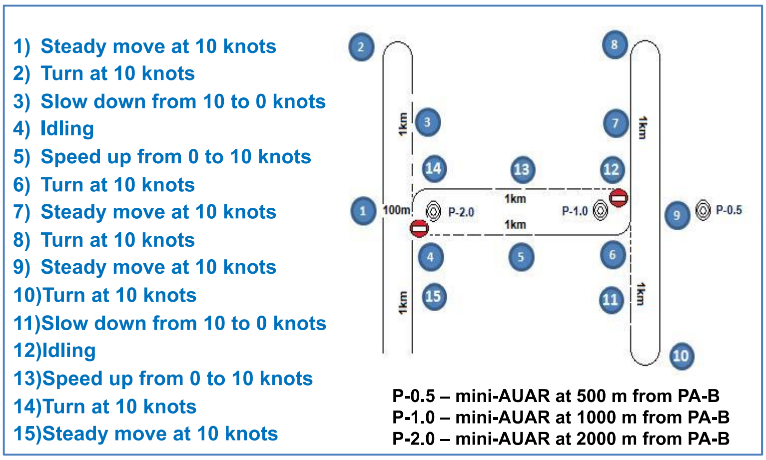

Figure 1. Schematic showing experimental design for RHIB/FRC experiments (and see text)

The manoeuvres shown in the figure and described in the text below for each critical stage are fairly elaborate and require detailed attention to ensure consistency. The Company indicated that this can be accomplished in the field and that detailed GPS waypoints will be given to the coordinated RHIB and FRC crews (the choice of crew is important for the experiment to measure vessel rather than driver differences). Ensuring that the necessary consistency is achieved and documented is the responsibility of the experiment leader.

(1) *Steady transit at 10 knots* – captures spectral noise levels for steady travel from fore and aft aspects on P2.0 station, and from broadside aspect on P1.0 station when at the closest point of approach (CPA).
(2) Turn at 10 knots – captures spectral noise levels for a course reversal manoeuver at 1km distance on P2.0 station.
(3) *Slow down from 10 to 0 knots* – captures spectral noise levels for a deceleration from cruise to stationary on P2.0 station.
(4) *Idling* – captures spectral noise level when holding position on P2.0 station.
(5) *Speed up from 0 to 10 knots* – captures spectral noise levels when accelerating from position holding to cruise speed, from aft aspect on P2.0 and from fore aspect on P1.0.
(6) *Turn at 10 knots* – captures spectral noise levels during a direction change at cruise speed on P1.0.
(7) *Steady move at 10 knots* – captures spectral noise level for steady travel from aft aspect on P1.0.
(8) *Turn at 10 knots* – captures spectral noise levels for a course reversal manoeuver at 1km distance on P1.0 station.
(9) *Steady move at 10 knots*– captures spectral noise levels for steady travel at fore and aft aspects on P1.0 station, and at broadside aspect on P2.0 station when at CPA.
(10) *Turn at 10 knots* – captures spectral noise levels for a course reversal manoeuver at 1km distance on P1.0 station.
(11) *Slow down from 10 to 0 knots* – captures spectral noise levels for a deceleration from cruise to stationary on P1.0 station.
(12) *Idling* – captures spectral noise level when holding position on P2.0 station.
(13) *Speed up from 0 to 10 knots* – captures spectral noise levels when accelerating from position holding to cruise speed, from aft aspect on P2.0 and from fore aspect on P1.0.
(14) *Turn at 10 knots* – captures spectral noise levels during a direction change at cruise speed on P2.0.
(15) *Steady transit at 10 knots* – captures spectral noise level for steady travel from aft aspect on P2.0.

(B) ACOUSTIC ANALYSES AND MEASUREMENTS

The standard continuous noise metrics of unweighted 1/3rd-octave band spectral density (RMS) levels will be analysed and provided for each vessel. These will be provided in each of the operational conditions described above for each boat and from each of the hydrophones.

(C) PROCESS FOR RAPID ASSESSMENT OF RESULTS

The Company expects that field data will be collected in mid-August, provided to POI by about 22 August and made available to the NTF small group by the end of August. The Company will provide an update to a small group (at least Donovan, Nowacek, Rutenko, Racca, Southall, Vedenev, Vladimirov) when the data are sent to the Pacific Oceanological Institute (POI) and an estimate as to when that small group can expect the results.

The small group will evaluate the data provided and assess the following for each vessel in operation:

(1) Overall (broadband - 20 Hz to 15 kHz) noise levels;
(2) 1/3rd -octave spectrum levels (RMS) across the sampled spectrum;
(3) Changes in noise conditions associated with changing operational modes.

Within a period of three days following receipt of the data, IUCN will organise a conference call to discuss the results and formulate specific recommendations regarding the relative noise signatures of each vessel in a variety of controlled but realistic operation conditions and any concerns regarding use of the FRC relative to the RHIB. These will be consolidated into specific recommendations from the NTF small group to the Company for operational use in 2013 (and beyond). The NTF recognises that this timetable is ambitious but will try to meet it as closely as possible given personal commitments in August.

2.3 Recommendation WGWAP-11/006: activities document

Evans presented an update to the Company's planned activities from 2013 to 2016. In essence, these are the same as reported to NTF-3 and WGWAP-12. The only difference is the maintenance work on the PA-A (Molipaq) and PA-B platforms planned for summer 2013. This work will require the support of two accommodation vessels (in previous years only one was used). It will allow the personnel offshore to be sufficient for executing a high workload. One additional benefit of having two vessels will be the reduced need for vessel movement between PA-A and PA-B.

The routine activities are summarised below. Future seismic surveys are dealt with under Item 6.2. The NTF thanked the Company for this information.

Period	Activity
2013	At the time of NTF-4, the Company considered to bring the second accommodation vessel (period June – November). However it will depend on the operational needs and potentially may not occur.
2014-16	• Each summer season at least one accommodation vessel (e.g. Heimdal) is expected; • Stabilisation of pipelines; • Single anchor leg mooring (SALM) decommissioning planning (execution timeline not yet agreed); • Oil Processing Facility (OPF) Compression Project: a temporary beach landing facility near OPF/ LUN-A for landing of large equipment >60km south of gray whale Offshore feeding ground and >120km from Piltun feeding ground.
2013-16	Well engineering: • No plans for further conductor piling in the foreseeable future; • Normal well engineering operations (as per workover and drilling plan).
2013-16	Platforms: • Routine vessel operations and vessel operations for activities below; • Diving operations – water jetting/clearing of marine growth from FPD's • Stabilisation of pipelines; • Crew-change vessel operations ("Polar Baikal" or "Polar Piltun"); • Emergency rescue and response (ERR) and oil spill response (OSR) standby PA-B ("Yury Topchev"); • Supply vessel operations at PA-A / PA-B, offload / backload ("Pacific" vessels).

2.4 Recommendation WGWAP-12/012: improved process for initial analysis of acoustic data

Donovan was pleased to note that this recommendation has been accepted. The data are considered later in the report (Items 3 and 4).

2.5 WGWAP-11 (Item 5.2.5): IUCN progress report on obtaining information from other companies and WGWAP-12 (Item 7.1.1)

Most of the discussion focussed on IUCN's efforts to obtain information on Rosneft's activities in 2010. In particular it was recommended at WGWAP-12 that IUCN request on behalf of the Panel that the Regulator (MNR) (1) provide the Panel with the Rosneft monitoring report for the period 18 August to 13 November 2010 and (2) authorise Sakhalin Energy to release the relevant acoustic data in the impulse noise format described in recommendation WGWAP-12/012, for particular acoustic buoys on specified dates (recommendation WGWAP-12/013).

Saksina reported that the request had been made but that due to administrative issues within the Russian Ministry Of Natural Resources and Ecology (MNR), the request has not yet been dealt with. IUCN will inform the NTF as soon as a reply is received. During the discussion, the NTF thanked Rutenko for the general information he presented on related acoustic monitoring work published in Rutenko *et al.,* (2012)[2], but noted that this was not sufficiently detailed for the NTF to carry out a proper review.

The NTF also received a progress report from Berzina on the website mapping effort to summarise information on oil and gas operations on the shelf. The NTF congratulated IUCN on this extensive work and it was agreed that individual members would assist in providing comments and information as the website progressed.

2.6 Recommendation WGWAP-12/026: regular teleconferences

Donovan noted that there had been several teleconference and these had been useful for tracking progress. He thanked Berzina for organising these.

3 REVIEW OF 2011 ACOUSTICS REPORT

Donovan recalled that the English version of the 2011 Acoustics Report had not been available in sufficient time for full consideration at WGWAP-12. A preliminary analysis of the 2011 acoustic data at that meeting had indicated that at least two issues should be discussed at NTF-4. He also noted that the Panel had agreed that in future, the NTF should undertake initial reviews of the annual acoustics reports rather than devoting time for detailed discussions of these reports at Panel meetings.

3.1 Exceeding thresholds for continuous noise during some periods

Donovan recalled that under Item 3.4 of the WGWAP-12 report, the Panel had requested that the Company provide an account of activities around the PA-B platform for specified periods of continuous loud noise (recommendation WGWAP-12/005).

The Company provided the NTF with detailed information on the activities for those periods, taken from logbooks, and summarised its efforts to relate these activities to the acoustic information obtained from the different buoys. Vladimirov stated that as this information was confidential it could not be summarised in the report.

The NTF thanked the Company for its thorough investigation. It was clear from the comparison of acoustic information obtained from the different buoys that the noise came from the vicinity of the platform. A number of suggestions were considered but none clearly explained the noise source. Based on the information provided and discussed, the NTF concluded that these periods of intermittent loud noise from the platform are not infrequent, may relate to different operational modes, and that subsequent investigation to further characterize the noise sources, levels, and periodicity are needed The NTF **agreed** that it was important to: (a) collect further information and continue trying to determine the sound source(s) so that appropriate mitigation cancan be

[2] A. N. Rutenko, A. V. Gavrilevskii, D. G. Kovzel', R. A. Korotchenko, V. F. Putov, and A. A. Solov'ev, 2012. Monitoring of Seismoacoustic Signals and Anthropogenic Noise on the Shelf of Sakhalin Island. *Acoustical Physics* 58 (2): 214-223.

developed; and (b) establish a more systematic way of examining the annual reports to identify periods of loud noise in order to ensure that guidelines for minimising potential disturbance to whales are met.

With respect to (a), in addition to the dedicated platform noise monitoring the NTF made two **suggestions** as outlined below. In both cases, it recognised the technical and permitting issues and noted that the Company's 6-day programme may make further work unnecessary.

(1) Record acoustic data for a full season of work using a POI buoy deployed close to the platform (within 2 km). Correlation of the acoustic data from that buoy with other Joint Programme monitoring buoys may help explain periods of unusually high noise levels that sometimes arise in areas close to platforms. In association with this, the Company should consider the possibility of finer-scaled (i.e. more often than only at 12 hr intervals) activity recording of particular events on the platform that might be considered 'noisy'.
(2) Install vibrometers on the platform itself. Correlation (comparison) of tonal components in spectra of vibrations recorded on the platform with acoustic data recorded by monitoring buoys would assist in determining sources of noise on the platform.

With respect to (b), the NTF agreed the recommendation given below and **commends** it to the Panel.

Recommendation to perform a comprehensive analysis of all acoustic records using an automated detector of loud noise periods of likely anthropogenic origin

Objective

To facilitate the detection of periods of elevated noise of likely anthropogenic origin in recorded data from an acoustic station with a view to identifying the sound source(s) and thereby enabling future mitigation.

Data requirements/analyses

A software detector should be identified with suitable capacity to recognise periods of elevated noise with spectral characteristics identifying it as anthropogenic. The detector should then be used to process all the data from the various acoustic stations deployed over a season. The identified periods of noise should then be reviewed manually to verify that the detection was correct, and suitable interpretation of the nature of the detected noise then carried out as appropriate.

The detector algorithm should be based on a two-stage approach:

(1) Detection of periods in the acoustic data for which the rms sound pressure level (SPL) computed over the frequency band 10-1000Hz exceeds specified thresholds (to be agreed by the NTF for each station – see below) for at least 15 minutes.
(2) Frequency domain analysis of the acoustic data within the periods identified in (1) to detect the presence of at least one tonal component within the same frequency range.

The detection of tonal components in the data can be achieved by a number of methods. One possible approach is to generate time-frequency intensity plots (sonograms) of the acoustic signal for the periods selected in the first stage and apply standard image processing algorithms such as contouring and blob analysis to detect the presence of linear shapes along the time axis in the density surface. This approach can detect tonal lines even in signals relatively cluttered by natural ambient or other non-tonal noise.

Responsible persons

The Company will suggest specified thresholds to the NTF before running the software. IUCN will co-ordinate the submission of the suggestions to the NTF and the holding of a teleconference to agree these.

Timeline

The work should be undertaken in time to allow the algorithm to be used for the 2013 acoustic data, and periods of elevated noise should be highlighted in a document to the Panel to assist in reviewing the 2013 acoustic report.

3.2 Position of the 'control' site

The objective of the establishment of a control site for an acoustic buoy in 2005 was that it far enough away from the activities of Sakhalin Energy and ENL that it would function as a reference for ambient noise primarily originating from wind and precipitation (mainly but not exclusively in the high part of the spectrum) and aggregated noise from distant shipping, seismic surveys or pile driving (mainly but not exclusively in the low part of the spectrum). However, as noted in the WGWAP-12 report, new activities have called into question the suitability/reliability of the present control site for its originally intended purpose[3].

Information provided to the NTF by Rutenko and others at this meeting as well as discussions during the JPTF and with participants in the Joint Programme have shown the value of keeping an acoustic buoy at the present site, maintaining the time series of data. The NTF **concurs** with this.

To investigate the tendency of background noise levels off north-eastern Sakhalin to change through time (due to gradually increasing industrial activity from 2005-2012) the NTF **suggests** that graphs of averaged (week, month) noise levels and spectra in a low-frequency band (up to 2 kHz) be presented for the present control site by year, along with 50% percentiles with the same averaging for the same years. This will provide valuable information on the change in noise levels over time. The Company informed the NTF that such work will be incorporated into the integrated analysis of Joint Programme data and that this should be available for the next NTF meeting.

In addition, taking into account present and likely future activities (e.g. ENL may undertake pier construction in Piltun lagoon at the end of 2014-2015), the NTF **suggests** that efforts be made to find an additional a new quiet area that more dependably reflects present 'natural' ambient conditions for comparison with areas where activities are taking place. The Company noted that the current 'control site' fulfils the Company's requirements, accepting it might not meet those of the Panel with respect to other noise. It noted that finding an additional new quiet area is not the responsibility of the Sakhalin Energy but that if the proposals are made, these can be considered at future NTF meetings.

4 REVIEW OF 2012 ACOUSTIC REPORT

In 2012, the Pacific Oceanological Institute (POI) deployed 15 Autonomous Underwater Acoustic Recorders (AUARs) to conduct acoustic studies on the NE Sakhalin shelf. The goal of the program was to acquire acoustic and hydrologic data, and to estimate sound propagation to the feeding areas of the western gray whale.

Acoustic measurements were initiated on 13th and 14th June at four monitoring stations – Arkutun-Dagi, Orlan, Molikpaq and Piltun-S – to monitor the levels of anthropogenic noise generated during the installation of the concrete gravity base structure (CGBS) for the Arkutun-Dagi Platform by Exxon Neftegas Limited (ENL). Two additional stations (Piltun-10 and Piltun) were installed on 14th June to monitor the levels of anthropogenic noise generated during a geotechnical survey by Sakhalin Energy Investment Company, Ltd. Intensive (up to 9 vessels) trawling for walleye Pollock in the offshore feeding area necessitated early retrieval of the AUARs deployed in the area; however, the AUAR deployed at the Arkutun-Dagi station was lost.

During seismic acquisition in the Piltun-Astokh Field the acoustic levels of seismic impulses at the Piltun-20 (Piltun) and Piltun-10 monitoring stations did not exceed: SPLpeak - 157 and142 dB re 1 μPa; SPLrms - 146 and 134 dB re 1 μPa; SEL - 140 and 125 dB re 1 $\mu Pa^2 s$

Anthropogenic noise generated by a group of vessels installing the Arkutun-Dagi Platform gravity base structure significantly exceed the acoustic background at the Orlan and Arkutun-Dagi monitoring stations located at the northern boundary of the Offshore feeding area. During the noisiest phase of the installation (from 25th June to 6th August, 2012), the SPLrms level from 15 Hz to 15 kHz reached 125 dB re 1 μPa at the Orlan acoustic monitoring station, located at the northern boundary of the Offshore feeding area.

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[3] For example, beginning on 12 August 2011, the broadband continuous noise level at this buoy rose above 120 dB and remained there until 15 August. For approximately five continuous hours during this period of time, the received noise levels actually exceeded 140 dB. This buoy is well north of the primary near-shore feeding area, but with respect to its function as a control site, these levels are troubling.

Constant low-frequency, narrow-band (tonal) signals generated by equipment operating onshore was recorded at the Odoptu-N-10 and Odoptu-N-20 monitoring stations. Foundation piles were driven on 21st and 22nd September. Analysis of the characteristics of acoustic impulses measured during the driving of the noisiest pile at the Odoptu-N-10 and Odoptu-N-20 monitoring stations indicated that the levels of the key impulse characteristics did not exceed the following: SPLpeak - 127 dB re 1 μPa; SPLrms - 114 dB re 1 μPa; SEL - 109 dB re 1 $\mu Pa^2 s$.

The acoustic conditions deteriorated slightly at the Odoptu-S-20 monitoring station compared to the 2011 monitoring season. In the 100-200 Hz band, the 25% and 50% one-third octave power spectral density percentile plots were a few dB higher, and a small power peak was present at 158 Hz. The anthropogenic noise came from the direction of the PA-B Platform, as indicated by the results of statistical analysis of the acoustic measurements at the Odoptu-PA-B and PA-B-20 stations. Anthropogenic noise at the PA-B-20 station has continuous narrow-band, low-frequency, quasi-harmonic components interspersed with more intense, wider-band noise apparently generated by workboats. The 90% and 75% one-third octave power spectral density percentile curves were approximately 6 dB higher in the 100-200 Hz frequency band; i.e., the acoustic conditions at that monitoring station were also worse than in 2011.

The 50% one-third octave power spectral density percentile curve, indicates that the acoustic levels at the Piltun and Molikpaq monitoring stations were approximately 10 dB higher in 2012 than in 2011, but they were practically the same at the Piltun-S station.

Acoustic measurements taken at distances of 500 and 1000 m from the Orlan Platform showed the constant presence of tonal and narrow-band noise signals generated by vessels and machinery operating on the platform in the frequency range up to 2000 Hz. The SPL_{rms} level from 15 Hz to 15 kHz measured 500 m from the platform during active operational phases exceeds 140 dB re 1 μPa, but declines to 110 dB re 1 μPa during quieter phases.

Seismic waves caused by a distant earthquake on 14 August, 2012 were sensed by the hydrophones of all AUARs. The recorded pressure variations $p(t)$ were predominantly in the infrasound frequency range (below 20 Hz), and the SPL_{rms}(2-50 Hz) exceeded 160 dB re 1 μPa. The 130 dB level was exceeded for 2 minutes.

During the expedition 270 vertical hydrologic profiles were acquired, allowing the hydrologic conditions present in the western gray whale feeding area, offshore Sakhalin Island to be evaluated. Three thousand and twenty six (3,026) km of bathymetry data were acquired in 2012. Hydrological conditions on the northeastern shelf of Sakhalin Island are influenced by atmospheric circulation over the Sea of Okhotsk and depend on the flow rate of the Amur River. There was upwelling over a large area near Piltun Bay during the first half of August 2012. The upwelling phenomenon was linked to the prolonged effect of southerly winds in July and early August. From the second half of August until early October 2012, there were no upwelling phenomena off the northeast coast of the island.

Amur River waters appeared off the Piltun Bay coast on 12th August, 2012. The slow flow of the Amur River due to the dry summer in Eastern Siberia and the southeastern monsoon in July, created hydrological conditions off the Piltun Bay coast in early August 2012 which were the antithesis of the warm, high-water year of 2010. The amount of incoming Amur River water did not increase in September 2012. The temperature and salinity distribution was homogenous in the two areas, and there were no thermohaline fronts. The temperatures of the surface and bottom layers in September 2012, despite the anomalously cold first half of August, were similar to September of the warm year of 2010.

Hydrological conditions of the bottom layers in the Offshore feeding area demonstrate the stability and year-to-year variation under different conditions of atmospheric circulation and at different Amur River flow rates.

The NTF **thanked** Rutenko for his usual thorough report. A number of issues were raised during the discussion of the report. These included:

(1) sounds that appear to be evidence of bottom trawling (this is probably a result of illegal crabbing – the legal walleye pollock fishery in the offshore area is not allowed to touch the bottom);
(2) the need to examine the results for high noise periods in the vicinity of the PA-B platform (see the recommendation above for automatic screening);
(3) levels at the Orlan station exceeded 125 db for a short period during the backfill (large gravel was used);

(4) the presence of a quiet period from about 15-21 June which may have been associated with the vessel operations schedule and which warrants further investigation;
(5) the question of the effects of noise on salmon, which is of local concern although not directly relevant to the Panel's work (Vedenev commented that the behavioral response threshold for salmon is similar to that for gray whales);
(6) the general need to try to associate the acoustics reports with activities (or the lack thereof) as also discussed under Item 3.

The NTF noted that the acoustics reports had been greatly enhanced by the recent changes to the format of the presentation of results. It **agreed** that their review by the NTF would be further enhanced by the presentation of associated relevant information on activities of the Company (e.g. vessel operations, platform activities etc.) associated with the noise information – this is relevant to quiet periods as well as noisy periods. The Company indicated that this should be possible and that it provides such information to Rutenko. However, the Company indicated that the content of Report is the subject for agreement with ENL and thus its information may need to presented separately from the report and may need to be confidential. While it would be valuable to have similar information for the activities of other companies, the NTF **recognised** that it would be difficult for Sakahlin Energy and IUCN to obtain this information at the level of detail required.

5 2-D SEISMIC (GEOTECHNICAL) SURVEY 2012

5.1 Analytical plans/results

Donovan recalled that the reports of NTF-3 and WGWAP-12 had noted the value of a written document or documents to summarise the different components of the work undertaken during the 2012 survey (e.g. shutdowns, operations under poor visibility, behavioural team protocols etc.). The Company had noted that such work was underway and provided a provisional timetable for reports.

The Company provided unofficial English translations of the behavioural and acoustic draft report from the 2012 survey. JASCO will be undertaking a comprehensive analysis of the behavioural and acoustic data that is expected to be completed by the end of 2013. It was noted that the sample size was such that the analyses presented would not be as extensive as had been the case for the 2010 4-D survey reported under Item 6.4.

The NTF **thanked** the Company for providing these reports, which were discussed in the light of the recommendations made at WGWAP-12.

5.1.1 Recommendation WGWAP-12/015: Initial analyses of behavioural data

Vladimirov noted that document WGWAP-13/13 had been prepared by the Russian Federal Research Institute of Fishery and Oceanography (VNIRO) in the light of recommendation WGWAP-12/015 as well as previous work undertaken by Gailey. He noted the team used the same equipment, same methodology and same software as was used by the previous team. This analysis was intended to show the consistency with previous work.

The NTF **welcomed** the report and the analyses undertaken. However, it was noted that recommendations WGWAP-12/015 and WGWAP-12/019 had been developed as a result of some concerns expressed about the success of implementation of the protocols given the difficulties the Company had found in obtaining experienced personnel. It was for this reason that NTF-3 and the Panel had wanted the report to be reviewed by Gailey or another experienced member of the previous teams. The Company noted that it had no doubts that the protocols used and the datasets obtained were consistent with previous work. It also noted that it did not have a contract with Gailey or his university and so had not been in a position to commission the review as requested by the Panel.

In conclusion, the NTF thanked the Company for the information presented and looked forward to receiving the completed analyses. However, it **agreed** that in light of recommendation WGWAP-12/019, it would request a review of WGWAP-13/13 document via IUCN. The results of the review will be transmitted to the Company as they may be of value to JASCO when undertaking its analyses.

5.1.2 Recommendation WGWAP-12/016: Additional analyses with respect to non-airgun low frequency noises

The NTF had discussed the sound produced by 'boomers' which were used in conjunction with the airgun arrays during the 2012 2D survey at its last meeting and agreed that additional information was required to determine their contribution to the sound levels produced (see recommendation WGWAP-12/016). At that time the Company presented a background study by JASCO that reviewed the properties of geotechnical sources including 'boomers' and compared their ranges for relevant sound level thresholds to those of small airgun arrays or single airguns. The comparison showed that the airgun sources, though smaller than the array used in the 2012 survey, far exceeded in range the other devices.

In response to recommendation WGWAP-12/016, Rutenko presented the results of an investigation into the sound levels of received pulses from a boomer-type sub-bottom profiler (Applied Acoustics model AA201) used during parts of the 2012 High Resolution 2D survey.

After a general introduction, he showed several sonograms (see WGWAP-13/12) of data collected shoreward of the survey region at the 20m (Piltun-20) and 10m (Piltun-10) bathymetry contours, showing that the time-averaged energy contributed by the airgun array pulses was clearly visible both on daily sonograms with 48-second averaging time and on longer-term sonograms with 7-minute averaging covering the period of monitoring from 22 June – 9 July 2012. The sonograms clearly illustrated significant transmission loss experienced by the pulses as they propagated shoreward into shallower water. A comparison of percentile spectral plots for periods with and without geotechnical survey activity at the two stations revealed that the spectral curves were markedly affected by the seismic pulses at the 50-percentile level for sound received at the 20m bathymetry line but only at the 75- and higher percentile level for sound at the 10m bathymetry line – another indication of the strong attenuation of the pulses propagating shoreward.

The seismic survey contractors had reported that the boomer was only operated concurrently with the airgun array and in fact when used together, they were operated simultaneously so that the pulses from the two would overlap in time. This mode of operation, if indeed in effect, precluded measuring the characteristics of boomer pulses alone. No evidence of non-airgun pulses were found in the analysis of the data. Two examples of received pulses and their spectra (23 June at 23:41, when both sources were reported to be operating simultaneously; 1 July at 08:11, when only the airgun array was reported to be used) were examined. In both cases, the distance between the seismic vessel and the receiver point (Molikpaq AUAR station) was approximately 6.5 km although the propagation path was somewhat different (from NE on 23 June and from NNE on 01 July). The received pulses in the two cases were fully consistent with the signal that could be expected from an airgun array, and any discrepancies in their amplitude and spectral content could be attributed to their different propagation paths. There was no evidence that the boomer pulses, if indeed they overlapped with the airgun array pulses, made a significant contribution to the resulting signal.

Rutenko also provided an example of boomer pulses propagating from a different operation, similar to that provided at NTF-3. He showed two instances of pulses from a boomer (though not necessarily of the same model or specifications) deployed on *Akademik Shokalsky* and measured from the *Igor Maksimov* in the Lunskoye area in 2004. In one instance, the boomer signal was measured at two known distances (by laser rangefinder) of 350 and 500m and shows a decrease in peak amplitude from 1200 Pa to 800 Pa and a corresponding marked drop with distance in spectral density levels. In the second instance, the range between the vessels was not documented but the acoustic data at CPA, taken at 22:31, showed clearly visible boomer pulses whereas subsequent data five minutes later (22:36) showed barely detectable pulses and data a further 10 minutes later (22:46) showed no sign of boomer pulses above the background. Rutenko indicated that an approximate assessment of the vessel tracks would suggest a path difference of about 3km between the CPA and the latter measurement, confirming the fact that boomer pulses would become essentially undetectable within that order of distance.

The NTF welcomed this information. It **concluded** that if boomers are operated concurrently with airguns, their contribution to the noise footprint is minimal so that mitigation measures for the airguns alone are sufficient. The NTF **agreed** that if circumstances arise where surveys are undertaken using boomers alone, then their noise footprint should be examined in the light of whale distribution and appropriate mitigation measures developed if necessary.

6 4-D ANALYSES

6.1 Report by the Company on analyses recommended at previous meetings (NTF-1 to NTF-3, WGWAP-10 to WGWAP-12)

The NTF has been considering the analyses of the 2010 4D MMP data for some time and has emphasised their great importance. At NTF-3 and WGWAP-12, several suggestions and recommendations were made related to analyses of the 4-D survey (e.g. recommendation WGWAP-12/017 to assist with the completion of the behaviour multivariate analysis (MVA) and WGWAP-12/018 to assist with developing additional hypotheses for consideration in future analyses as well as a number of suggestions for the distributional and density MVAs).

Documents were made available on the behavioural and the distributional MVAs for review at this meeting.

6.1.1 Behaviour MVA

The purpose of the behavioural MVA was to examine the effectiveness of the mitigation and monitoring efforts to minimise impacts on whale behaviour relative to vessel proximities and sound level exposure during the seismic survey. It was also expected to provide information on whether the existing behavioural response threshold levels are appropriate. Mixed linear models were used to study deviations from 'normal' patterns in 10 movement and 7 respiration response variables in relation to separation distance, whale orientation and received sound level to examine if the noise from the seismic survey influenced gray whale behaviour. None of the response variables was found to be significantly associated with seismic noise. Distance of whales from shore and whale orientation were found to be significantly influenced by vessel proximity. Power analyses suggested that this study had a large enough sample size to detect large (50% change in distribution of natural movement/respiration behaviour) population-level responses, but that sample sizes were too small to detect moderate to subtle effects. The absence of movement and respiration responses to the seismic sounds could have signalled effectiveness of the mitigation and monitoring strategy, but alternatively sample sizes may have been insufficient to detect any effects of these kinds. The small sample size was mainly due to the primary mitigation measure of completing the survey as early in the season as possible when the number of whales in the area was low.

The NTF **welcomed** this report which had incorporated and responded to its recommendations. The analysis had been thoroughly undertaken and the conclusions justified. In particular it thanked Gailey, Broker and colleagues. This work can now be considered completed and the Task Force looks forward to its publication. The lessons and results will be valuable in the planning for future Monitoring and Mitigation Programmes (MMPs).

6.1.2 Distribution MVAs

In order to examine whether there were changes in mean daily western gray whale densities in response to seismic sound exposure, two-part and mixture Bayesian zero-inflated hierarchical models with detection, environmental and space-time effects were applied to a surface of 1 km by 1 km grid cells. Temporal blocking over a day was conducted to address the problem arising from the large number of non-zero cells. Higher sound levels in the middle of a 3-day sound accumulation time window, i.e., during the preceding 24 to 48 hours, were significantly associated with decreased gray whale densities at grid cell locations. The evidence for this effect was weak, however, because the upper bound for the Bayesian credibility interval bordered on zero. Gray whale presence, i.e., the probability that a 1 km by 1 km grid cell within the shore-based monitoring area would be occupied by at least one whale, appeared to decrease slightly in the area that experienced the highest sound levels from the seismic airguns. Analyses were limited due to the seismic survey’s primary mitigation of being conducted as early in the feeding season as possible when relatively few gray whales were present. This resulted in few positive densities on which to assess changes that might have occurred as a result of seismic sound exposure.

In order to assess changes in mean gray whale sighting distance from shore, linear mixed effects modelling was used. This modelling included fixed effects for detection, state and seismic covariates, and random effects for station and heterogeneity among stations. Poor visibility conditions and earlier time of day were negatively associated with sighting distance from shore. No significant effects of seismic sound covariates were found.

For all three MVAs (behaviour, density and distance from shore), poor weather conditions in the post-seismic survey monitoring period meant that there was little survey effort and thus only limited statistical power, to compare behaviour and distribution during periods of seismic survey activity versus periods of low anthropogenic sound following the end of the seismic survey.

The NTF welcomed this report which had incorporated and responded to earlier task force suggestions and thanked Muir, Broker, and other authors for their careful and thorough analyses. It noted that the conclusions would be valuable for planning MMPs for future surveys.

6.1.3 Progress with publications

Broker informed the NTF that preparations for publication of a number of papers from the 2010 4D survey effort were in hand. The likely topics were:

- Overview of field process;
- Perimeter monitoring line (PML) establishment;
- Behavioural MVA;
- Distribution MVAs;
- Acoustic monitoring and mitigation approach;
- Noise cases / individual responses;
- Power analysis.

The preferred option is for all of the papers to be published in a special edition of a journal. The NTF **welcomed** this news and thanked the authors for their efforts.

6.1.4 WGWAP-12/018 Alternative hypotheses for the effects of noise on cetacean behaviour

Cooke introduced NTF-4/7, produced in response to recommendation WGWAP-12/018. IUCN had sent a letter (prepared by Cooke) to a number of experts on the effects of noise on cetacean behaviour. This letter had described briefly the data collected during the 2010 seismic survey and in previous years, and had requested advice and input on hypotheses concerning the effects of noise on gray whales that would be worth testing against these data.

In summary, the following issues were raised in the replies received:

(1) the magnitude of the response can change sign with the intensity of the dose, and different classes of animals (e.g. reproductive state, mother-calf pairs, body condition, time within a season) may respond differently;
(2) analyses should note and take into account whether the same animals are recorded (sampled) multiple times;
(3) observable behavioural changes may not be good measures of impact or exposure (e.g. nutritionally stressed animals may be affected but cannot afford to abandon feeding);
(4) the limitations of hypothesis testing must be recognised (power analyses have shown that even quite large effects may not be detectable);
(5) measures of exposure (and frequency bands) must be evaluated and chosen carefully;
(6) it is important to have data from, during and after the exposure period (data from more than one year may be used but year should then be used as a factor in the analysis);
(7) consideration should be given to the possibility that behavioural effects of exposure last much longer than the exposure itself, causing post-exposure behaviour to be similar to that during exposure.

The responses also provided information on different modelling approaches with case studies given for bottlenose dolphins and harbour porpoises. Potentially these models would be useful for generating impact scenarios and evaluating consistency with the observed data.

The NTF **thanked** Cooke and IUCN for the information provided as it may be useful in planning future studies. It cautioned, however, that the data available thus far are probably insufficient to warrant further work beyond that already undertaken. It was **agreed** that IUCN should make the individual responses available to NTF members and include any references received from respondents in the library that that is being compiled for the WGWAP website.

6.2 Future 4-D surveys

At WGWAP-12, the Panel had acknowledged the information from the Company that a seismic survey would occur in the period 2014-15 and it was agreed that planning should begin as soon as possible, using the 2010 MMP as a base; experience has shown that adequate planning takes time. At this meeting, the NTF was provided with additional information on future surveys.

6.2.1 Company summary

In summary, the Company[4] noted that it is planning for a 3D/4D survey in 2015 across Piltun Astokh as part of the ongoing reservoir monitoring effort. Typically a repeat survey would be foreseen every 3 years thereafter.

The objectives of the survey in 2015 are to:

- undertake seismic monitoring of hydrocarbon production and water injection at the Piltun and Astokh fields; and
- provide a state of the art 3D image for planning of future production wells from the existing facilities.

The following scope of work is proposed:

- Second repeat survey across Astokh, following the 1997 survey and the 2010 4D survey. This will include an undershoot of the Molikpaq platform (this might be undertaken using Ocean Bottom Cables (OBC) or Ocean Bottom Sensors (OBS)). The Astokh survey will entail 145km^2 of streamer seismic;
- First repeat survey across Piltun, where only the 1997 baseline survey exists. This will include an undershoot via OBC or OBS. The streamer survey will covercover approximately 140km^2;
- There will be options to record re-shoots across South Piltun and the Piltun East Flank; each of these options will be around 100km^2 of possible additional scope. The objective for these re-shoots would be to obtain a higher resolution image, as no production occurs at either South Piltun or the East Flank. The company will decide later whether to execute these options.

If the options are included, this programme will result in a total survey area across Piltun-Astokh of around 500km^2.

Given the Company's present understanding of the producing reservoirs, 2015 is considered optimum timing for the new survey. This would meet the requirements to detect production effects and be able to respond in a timely fashion to information obtained from the 4D surveys.

In terms of operations in 2015, the Company indicated that the 2010 Astokh survey will form their reference. The seismic source will be comparable to that in 2010 (which was a 2620 cubic inch airgun array operating at 2000 psi). In terms of mitigation, the plan at present is to:

(1) start the survey in early June as soon as the sea is "ice free";
(2) shoot the lines modelled as producing 'high noise impact' first;
(3) have Marine Mammal Observers (MMOs) on board with the authority to shut down operations if necessary;
(4) sighting whales within 1km will lead to a pause of acquisition, with a 'soft start' thereafter.

The scope of work is greater than that executed in 2010. In order to restrict the Piltun-Astokh survey to one summer season, the operation must therefore be more efficient. The Company planned to:

(1) use more (8-10) streamers than in 2010 (6) to reduce the need for infill shooting. Infill shooting results from cable feathering due to unpredictable currents, which lead to unwanted gaps in subsurface coverage - streamer separation will remain 100m and streamer length at 4.5km;
(2) use modern streamers that can be towed deeper while at the same allowing retention of a broader frequency spectrum in the recorded data - towing deeper means the vessel can continue acquiring in marginal weather conditions, thus reducing weather downtime;
(3) such state of the art streamers will come with modern vessels, which tend to be quieter.

6.2.2 Discussion

The NTF **thanked** the Company for providing this new information. It noted that the proposed programme covers a greater area and is more frequent than had previously been envisaged by the Panel. It is clear that even with the MMP work undertaken for the 2010 survey, the NTF has considerable work to undertake prior to 2015 with respect to developing an MMP. For this to occur, it will need detailed information on equipment, areas and

[4] Marko van der Veen presented the information and joined in the discussion by telephone.

lines as soon as possible. The Company noted that the tender process should be completed by the end of the year and at that time it will be able to specify the vessel and the equipment.

The NTF noted that the primary mitigation approach had been to survey as small an area as sufficient and to carry out the seismic survey as early in the season as possible (i.e. when fewer whales were present). This had been successful in 2010 but even with proposed efficiencies it will be a challenge in 2015. Considerable effort will be needed to examine the proposed areas and lines, the modelled noise footprints and the whales' temporal and geographical distribution. This work should begin as soon as sufficient data become available, i.e. early in 2014.

The NTF also referred to previous Panel and Seismic Survey Task Force (SSTF) discussions on the use of new technologies and/or the use of less power when undertaking new rather than repeat surveys, such as those envisaged for the South Piltun and the East Flank. The Company indicated that while it would consider these, there are practical issues in terms of availability of equipment and having this on board the same vessels. There is also a risk of delaying the whole process if gun configuration is changed. The NTF **agreed** that given the long-term implications for repeat surveys, it was important for it to receive and review information on the Company's deliberations on the evaluation process and rationale on this matter.

The NTF **agreed** that it should hold its next meeting early in 2014 when additional information becomes available.

7 PROGRESS REPORT ON SOUTH PILTUN PROJECT WITH RESPECT TO NOISE

7.1 Presentation by the Company

Towards the end of 2012, Company's shareholders endorsed proceeding with a 'Just-in-Time' Platform concept for South Piltun with a construction phase linked to Lunskoye off-plateau date (2022-2028). The concept comprises an oil and gas production facility fully integrated into Company's current infrastructure. An accelerated development (on stream 2019) may be pursued depending on the outcome of ongoing review of the Liquid Natural Gas (LNG) capacity (and number of trains).

Shareholders also supported the Company's recommendation not to drill an appraisal well (through a dedicated Jack-Up rig) in 2014 but rather to investigate alternative methods of data gathering through the existing assets.

The Company is currently undertaking four investigative studies to underpin the above recommendations and determine whether any additional value can be added (to what remains a marginal opportunity) through integrating the South Piltun Platform more closely to the existing infrastructure. These studies include considerable specialised information which can be summarised as:

- *PA-C Stand-alone Concept Optimisation*
  This work scope comprises the optimisation of concept within current agreed frame (PA-C located at "Blue Location" midway between PA-B and PA-A);
- *Benchmarking (identification cost reduction opportunities)*
  The objective of this work is to better understand the Sakhalin specific prices which, in some circumstances, can be a multiplier of international prices. And, through understanding, identify area where costs could be reduced through alternative contracting and procurement strategies;
- *Lessons Learnt*
  The objective of this work is to improve design, contracting strategy and execution of Arctic projects by incorporating "lessons learnt" from elsewhere in the industry;
- *Explore alternatives: Long-term future of Molikpaq as stand-alone entity or integrated into PA-C*
  This work seeks to investigate whether the creation of a single production entity combining the existing Molikpaq facility and a new PA-C platform would be able to recover both the Astokh and South Piltun reserves while reducing total company operating expenses and improving the long term functionality of the Molikpaq structure (production and drilling facilities).

In short, there are no immediate work implications for the NTF.

7.2 Discussion

There was some discussion of the need for more manpower (and hence the extra crew vessel) on Molikpaq. There are limitations in terms of weight of topside, compression and rig resources. As a result extended reach drilling is not possible. The platform requires more and continuous maintenance. The Company is concerned with preventative and routine maintenance and implications for frequency of shutdown. They have adopted a preventative maintenance strategy rather than longer periods of shutdown.

7.3 Conclusions and recommendations

Given the information provided by the Company, it is clear that there are no new noise implications for the NTF to consider for South Piltun apart from those related to seismic surveys discussed under Item 6.2.

8 CUMULATIVE IMPACTS

Donovan noted this has been a long-standing item on the NTF Agenda. The Panel had agreed recommendation WGWAP-12/022 with respect to (a) defining relevant terms to enable a more focussed discussion; and (b) compiling the relevant literature (published and 'grey') including the work off West Greenland, ideally one month before the NTF.

8.1 Progress on definition of terms

Southall and Vedenev had undertaken some intersessional work on the definition of relevant terms. There is a considerable body of work in this field and a number of different definitions and concepts, often related to the specific focus (e.g. habitat, species, geographical area etc.). They had decided to initially develop the draft definition below for consideration by the NTF, and ultimately the Panel, that took into account the specific case of western gray whales. While it is recognised that the WGWAP is primarily concerned with the Sakhalin feeding area, cumulative effects/impacts are relevant to the whole range of the animals.

> *'The cumulative effects of industrial development for Sakhalin gray whales encompasses both short-term responses resulting from multiple overlapping and potentially disturbing activities in the same general space, as well as the chronic degradation of the physical and acoustic environment resulting from the overall increase in human pressures on the area.'*

At this stage, they had not developed draft definitions of related terms. The first part of the definition is concerned with immediate responses; the second with long-term exposure leading to degradation of the environment.

The NTF thanked them for their work and noted that the discussion of cumulative effects and related terms was much broader than simply the focus of the NTF, i.e. noise. However, the nature of noise (e.g. it can be turned on or off) was in some ways rather different to other types of potential stressors such as say pollutants or physical damage to the habitat which accumulate in a more traditional sense, hence the reason it appears (and has appeared) on the NTF agenda, as well as that of the Panel. While noise itself may not 'accumulate' in the usual sense, it can have cumulative physiological and/or psychological effects that may translate into impacts. Broadly distributed noisy operations that increase habitat denial over a large area may be more serious than increased noise within a single area.

Recognising that the Panel itself would be responsible for the broader consideration of this topic, the NTF had a short initial discussion of the concepts that will feed into the Panel's consideration. The issues highlighted with respect to definitions are summarised briefly below:

(1) it is important to define and distinguish between effects (which in principle can be positive or negative and often thought of as 'immediate') and impacts (which in principle can be measured on individuals and/or populations on appropriate time-scales) – these are sometimes used as synonyms in the literature;
(2) related concepts such as direct, indirect and interaction impacts (at particular geographical and temporal scales) which have been used in the literature should be considered, and definitions developed in a WGWAP context as necessary;
(3) the concepts of aggregation and accumulation from both a short-term and long-term perspective should be considered and defined.

In the light of the discussions, it was noted that cumulative impacts result from the incremental effects of an action when considered together with other past, present, and reasonably foreseeable future actions, regardless of who takes the other action. These incremental effects may become significant even though the effects of each action, when independently assessed, are considered insignificant.

Beyond the issue of definitions, the discussions within the NTF also highlighted a number of general issues in addition to those covered above for Panel discussions. As has been noted on many occasions, a full discussion and evaluation of cumulative effects impacts is a major challenge from a number of perspectives:

- the need to obtain good information from the large number of players from both the oil and gas industry and other potential causers including fishermen, even within the Panel's main area of interest i.e. Sakhalin;
- the considerable scientific challenges of moving from information on activities that may affect whales through to quantifying short-term effects, to translating these to the assessment of impacts on individuals and ultimately the population (including the need to take into account activities elsewhere in the range);
- the need to be predictive in order to be able to develop mitigation measures;
- the ultimate need (although beyond the remit of the Panel), for a coordinating body (whose scope may involve high seas as well as national waters of more than one jurisdiction) with appropriate powers to examine aggregate and cumulative issues and develop appropriate mitigation measures across companies/industries - sustaining the long-term monitoring at specific locations and relating this to environmental and anthropogenic activities and whale use patterns is critical to begin to be able to address these issues and the sharing of information from other operators as possible is encouraged.

8.2 Literature compilation

IUCN reported that this work was at an early stage and requested that NTF members assist the Secretariat in identifying (and, if possible supplying) references. The NTF **agreed** to assist and noted that this should be a focussed exercise and completed prior to the next Panel meeting.

8.3 Progress report on activities related to cumulative impacts

The NTF and the Panel have discussed a number of initiatives in the past including Population Consequences of Disturbance (PCoD), and the Cumulative Effects Working Group convened by the University of California, Santa Barbara, and funded by British Petroleum (BP). No new information on those initiatives was available since the last meeting.

SEIC made a short and informal presentation illustrating some of the issues associated with defining cumulative effects (CE) and stressing the fact that they are different from cumulative impacts (CI). The NTF **concurred** that it did not yet have an agreed set of context metrics describing, for example, the functional spatial area of interest (which could range from only the north-eastern Sakhalin shelf to the entire range of the whale population); the functional range of noise sources (Company's annual activities versus its total activities or even all operators' activities); or the time period associated with collection and analysis of data looking for effects/impacts. The presentation also introduced the link between CE and CI within the context of the International Finance Corporation (IFC) Performance Standards, where Cumulative Impact must be addressed. The IFC, recognising the difficulties in interpretation for representatives of lenders and borrowers, has recently undertaken a consultative process on CI. The results have not been published to date.

The NTF **agreed** to develop its knowledge of CE/CI, to look for supporting examples of projects and methods, and to advise the Panel and the Company to include CF/CI on the agenda of WGWAP-14 to discuss further how this issue can be addressed in practical terms.

Reference was made to the Canadian study of Erbe and colleagues[5] on large scale noise distribution from coastal vessel traffic, and the need to have considerable information (including Automated Information System (AIS) data, noise profiles of vessels etc.) to develop a holistic description on activities in the area was highlighted. This work is difficult even with full information available, and more so when only incomplete intelligence about activities can be gathered. It was suggested that studies such as that of Erbe and colleagues could be used as

[5] Erbe, C., MacGillivray, A. and Williams, R. 2012. Mapping cumulative noise from shipping to inform marine spatial planning. *JASA Express Letters*. Published online on 16 October 2012.

examples to highlight information gaps for the western gray whale situation with a view to determining prioritised information needs for creating a cumulative impact statement.

Broker reported on a case study of aggregate sound level modelling by Shell in the Baffin Bay off west Greenland. As part of Greenlandic regulatory requirements, as outlined in the ‘Guidelines to EIA of seismic activities in Greenland waters’ (National Environment Research Institute Report, 2010, 3rd edition), sound propagation modelling studies are required prior to each survey, with estimates of received sound levels presented as peak-to-peak SPL, rms SPL (90% of pulse duration), sound exposure level (SEL) per pulse and 24hr cumulative Sound Exposure Level (cSEL). In case of multiple seismic surveys in one area, there is also a requirement to model aggregate sound levels (24 hr cSEL) taking into considerations all industrial sound sources. In 2012, four seismic vessels were operating simultaneously in four adjacent license blocks. Broker provided examples of a number of modelling results including examples of maps depicting aggregate sound levels as generated by these 4 seismic sources (unweighted and M-weighted cSEL). He noted that whereas the Southall (2007) criteria provide some guidance on injury thresholds, interpretation of this acoustic metric (24h cSEL) in terms of behavioural responses is challenging. Acoustic measurements were also conducted in the Shell’s license areas to (a) measure sound levels in the license areas, (b) verify the accuracy of the modelled results, especially over larger distances (e.g.>10km) and (c) fill data gaps on presence of marine mammals in the license areas. The NTF commented on the fact that the collaborative effort by the operating companies to conduct aggregate sound modelling studies was largely driven by regulatory requirements, and agreed that this could be used as a paradigm for other areas including the Sakhalin shelf.

9 FUTURE WORK OF THE PANEL AND THE NTF RELATED TO NOISE

The NTF **agreed** that its future work should be related to the following issues:

(1) Regular review of Annual Acoustic reports;
(2) Cumulative effects;
(3) 2012 2D analyses;
(4) Planning MMPs for future seismic surveys.

As noted under Item 6.2, it is important that the NTF begin work on (4) as soon as information becomes available, probably in early 2014.

10 OTHER BUSINESS, INCLUDING COMMENTS ON STATUS OF OUTSTANDING RECOMMENDATIONS

A small group was convened under Donovan to review and update the status of all open noise-related Panel recommendations. This information was provided directly to IUCN.

11 ADOPTION OF REPORT

Donovan thanked the participants for their usual hard work and co-operative approach to some challenging technical issues. He also thanked IUCN and the translators for their excellent support. As no time had been allocated to draft the report between the close of the meeting and the WGWAP, he would present a Chair’s summary to the WGWAP and remain in Tokyo for two days to compile a draft report. He would circulate this to the participants by 21 May and requested comments by 27 May. The report was adopted by email.

Annex A - List of participants

Koen Broker (Sakhalin Energy)
Justin Cooke (WGWAP)
Mike Donaghy (Sakhalin Energy)
Greg Donovan (WGWAP)
Richard Evans (Sakhalin Energy)
Roberto Racca (Sakhalin Energy)
Randall Reeves (WGWAP)
Alexander Rutenko (Sakhalin Energy)
Brandon Southall (WGWAP Associate Scientist)
Grigory Tsidulko (WGWAP)
Dave Weller (WGWAP)
Alexander Vedenev (WGWAP)
Alexey Vladimirov (Sakhalin Energy)

IUCN

Tatiana Saksina
Anete Berzina
Sarah Humphrey (rapporteur)

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 PREVIOUS MEETINGS
2.1 WGWAP-12/001: Task Force recommendations and responses by the Company
2.2 Joint Programme Task Force report: any implications for the Noise Task Force
2.3 WGWAP-11/006: activities document
2.4 WGWAP-12/012: improved process for initial analysis of acoustic data
2.5 WGWAP-11 (item 5.2.5): IUCN progress report on obtaining information from other companies
2.6 WGWAP-12/026: regular teleconferences

3 REVIEW OF 2011 ACOUSTIC REPORT
3.1 Exceeding thresholds for continuous noise during some periods
3.2 Position of the 'control' site
3.3 Other matters

4 REVIEW OF 2012 ACOUSTIC REPORT

5 2-D SEISMIC (GEOTECHNICAL) SURVEY 2012
5.1 Analytical plans/results
5.1.1 WGWAP-12/015: Initial analyses of behavioural data
5.1.2 WGWAP-12/016: Additional analyses with respect to non-airgun low frequency noises
5.2 Conclusions and recommendations

6 4-D ANALYSES
6.1 Report by SEIC on analyses recommended at previous meetings (NTF-1-3, WGWAP-10-12)
6.1.1 Behaviour MVA
6.1.2 Other MVAs
6.1.3 Progress with publications
6.2 Future 4-D surveys
6.3 Conclusions and recommendations

7 PROGRESS REPORT ON SOUTH PILTUN PROJECT WITH RESPECT TO NOISE
7.1 Presentation by SEIC
7.2 Conclusions and recommendations

8 CUMULATIVE IMPACTS

9 FUTURE WORK OF THE PANEL AND THE NTF RELATED TO NOISE

10 OTHER BUSINESS, INCLUDING COMMENTS ON STATUS OF OUTSTANDING RECOMMENDATIONS

11 ADOPTION OF REPORT

Annex C – List of Documents

Note: The list below includes only additional documents submitted for NTF-4 besides a number of WGWAP-13 documents related to noise issues, see at http://iucn.org/wgwap/wgwap/meetings/wgwap_13/

DOCUMENT #	TITLE	LANGUAGE	STATUS
NTF-4/1	Provisional agenda (including time schedule)	English	Public
NTF-4/2	List of documents distributed in connection with the 4th meeting of the WGWAP Noise Task Force	English	Public
NTF-4/3	Western gray whale distribution and abundance during a 4-D seismic survey off north-eastern Sakhalin Island, Russia, 2010	English	Confidential
NTF-4/4	Abstracts for a series of seven contributed papers on Mitigation and Monitoring of a 4-D Seismic Survey in the vicinity of a Critically Endangered Population of Gray Whales, that are in various stages of preparation	English	Confidential
NTF-4/5	Responses in movement and respiration of western gray whales to a 4-D seismic survey off north-eastern Sakhalin Island, Russia, 2010	English	Confidential
NTF-4/6	Memo, which addresses the recommendation WGWAP-12/017 to do further power analyses on the behavioural parameters	English	Confidential
NTF-4/7	Memo on recommendation WGWAP 12/018: Summary of responses from contacted experts for their advice and input on hypotheses concerning the effects of noise on gray whales that would be worth testing against the data	English	Public
NTF-4/8	Memo on recommendation WGWAP 12/018: Full responses from contacted experts for their advice and input on hypotheses concerning the effects of noise on gray whales that would be worth testing against the data	English	Public
NTF-4/Inf.1	European Commission Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 1999	English	Public
NTF-4/Inf.2	IUCN Compilation of information sheets for the interactive map on oil and gas projects & prospects in the Sea of Okhotsk in the vicinity to Western Gray Whale feeding grounds, range distribution and migrations routes of tagged whales, version of 05.05.2013.	English	For NTF internal use only