

## **Executive summary**

### **Background**

#### **The animals and their status**

The small population of western gray whales, numbering only about 100 animals, is on the edge of survival. It was reduced to such low numbers by commercial whaling that in the mid 20<sup>th</sup> century it was thought to be extinct. The population is listed by IUCN – The World Conservation Union as ‘critically endangered’ and also has been the focus of concern by the International Whaling Commission (IWC) and the 3<sup>rd</sup> World Conservation Congress. The few surviving animals (possibly including only 23 reproductively active females) face a number of hazards throughout their range. It is particularly unfortunate that the only known foraging grounds for the population lie along the northeastern coast of Sakhalin Island, where existing and planned large-scale offshore oil and gas activities pose potentially catastrophic threats to the population. These include the possibility of direct kills from collisions as well as reduced reproductive success and survival through the degradation of this crucial habitat as a result of physical disturbance, oil contamination of the whales and their prey and the introduction of loud noise. Two major development projects – Sakhalin I and Sakhalin II – occur close to the nearshore and offshore feeding areas and their activities are of great conservation concern.

#### **The Panel and terms of reference**

Under the auspices of IUCN, an independent scientific review panel (hereafter called ‘the Panel’) was established to evaluate scientific aspects of western gray whale conservation in the context of Phase 2 of Sakhalin II, an integrated oil and gas project being developed by the Sakhalin Energy Investment Company (SEIC) under a production sharing agreement with the Russian Federation and its Sakhalin Oblast. Phase 1 of Sakhalin II has already been in production for six years, producing oil for approximately six months each year during ice-free conditions. Phase 2 is intended to allow production of both oil and gas year-round, with production commencing in November 2007, and it will greatly enhance the project’s economic productivity. It is expected to entail construction of two new offshore platforms, offshore and onshore pipelines, and onshore processing and exporting facilities.

The terms of reference for the review were developed and established by IUCN in consultation with SEIC, potential lenders and other stakeholders. The underlying question was whether the risks associated with Sakhalin II Phase 2 are being, or will be, managed in an effective manner that will allow oil and gas development to proceed without further jeopardising the survival and recovery of this critically endangered whale population. The Panel was required *inter alia* to review the plans of SEIC and consider their proposed mitigation measures for minimising the possible impacts of operations on gray whales and ‘related key elements of biodiversity’ (interpreted by the Panel to mean the benthic communities on which the whales rely for sustenance). Whilst focussing on Sakhalin II Phase 2, the Panel had to consider the cumulative effects of the entire Sakhalin II project, other oil and gas projects (especially Sakhalin I) and other human activities in this region and throughout the population’s range. The Panel was not asked to develop prescriptive conclusions, but rather to provide an evidence-based analysis of issues and options.

#### **The process and documentation**

The Panel held four meetings: 6-8 September 2004 in Toronto, Canada; 2-7 October 2004 in Yuzhno, Sakhalin Island, Russian Federation; 6-8 November 2004 in Sausalito, California, USA and 27-31 January 2005 in Seattle, Washington, USA. The Panel received and reviewed a tremendous amount of documentation (most notably the Comparative Environmental Assessment, or CEA) and received considerable assistance from both SEIC and IUCN. It was clear that SEIC have invested substantial sums of money into research on western gray whales, the assessment of risks associated with Sakhalin II and the development of approaches to try to reduce the risks of their project to gray whales.

#### **overall conclusions**

The Panel’s report provides a detailed consideration of the risks, the options for mitigation and the need for monitoring if and as oil and gas development proceeds. Despite the considerable documentation provided by SEIC, important information gaps left considerable uncertainty over many aspects of risk evaluation and the efficacy of

proposed mitigation measures. Those gaps pertained not only to important scientific information on the whales, their prey resources and their habitat, but also to the SEIC decision-making process. SEIC have applied a conventional risk-reduction standard, whereby risks are to be reduced to levels ‘as low as reasonably practicable’ (ALARP). The Panel often was unable to determine just what that meant, and how various considerations (e.g. cost-effectiveness, conservation) were considered and weighed in decision-making. The lack of specificity associated with SEIC’s application of the ALARP standard to important decisions, such as location of the proposed PA-B platform, effectively precluded the Panel from completing a reasoned and rigorous evaluation of some of the risks and mitigation strategies associated with Phase 2.

## **Examining the cumulative effects of threats on gray whales**

The fate of western gray whales will ultimately depend on their ability to cope with the cumulative effects of multiple anthropogenic and natural factors on both the whales themselves and on the prey communities that sustain them. Given the uncertainties and the precarious state of the population, which precludes any possibility of direct experimentation, the only way to examine cumulative effects and risk is through population modelling under various assumptions of threats and their possible effects. Among other things, the results of a limited modelling exercise undertaken by the Panel showed that:

- even with no additional risks to the population beyond those it faces at present, there is some risk that the population will not recover;
- this risk is increased, in some cases substantially so, under the various impact scenarios considered plausible by the Panel (which were not necessarily ‘worst case scenarios’);
- persistent effects are more serious than acute (short-term) effects of larger magnitude;
- additional whale deaths, regardless of the cause, have the most serious consequences for the population – most importantly, the loss of one additional female per year (over and above the death rates experienced in recent years) would be sufficient to drive the population towards extinction with high probability.
- effects that may be too small to be detected in the short term (such as a 10% reduction in breeding success combined with the loss of one additional female every 3 years) can prevent population recovery if they persist.

Perhaps the most important lesson to be learned from this modelling exercise is that the anticipation and avoidance of potential risks to the population is essential. Waiting for conclusive scientific proof that a particular activity or set of activities is having a population-level effect is not an appropriate approach for ensuring the conservation of this population. Action to prevent or mitigate risk needs to be taken based on the assumption that an impact will occur, until it is shown that it will not. The survival of the population in the context of development impacts cannot be assured until the potential extent of impacts can be better quantified and shown, using a demographic model such as the one employed here, to be within the limits that the population can sustain with high probability.

In this context, annual monitoring of the population through uninterrupted continuation of the collection of photo-identification data, biopsy sampling of new individuals and refinement and updating of the population model, is essential. The loss of a single year of data would limit our understanding of critical population parameters and our attempts to evaluate, detect and predict the cumulative impact of threats to the population.

## **Advice**

Once completed and fully operational, Phase 2 will considerably reduce certain types of risk to gray whales, specifically those associated with the current procedure of transferring oil from the PA-A platform into tankers for transport to distant markets. However, a number of other risks will increase as Phase 2 construction activity proceeds, and some of those risks will remain throughout the lifetime of the project.

Given the potential effects of the identified risks, as well as the uncertainty surrounding them and the questionable efficacy of proposed mitigation measures, the most precautionary approach would be to suspend present operations and delay further development of the oil and gas reserves in the vicinity of the gray whale feeding grounds off Sakhalin, and especially the critical nearshore feeding ground that is used preferentially by mothers and calves. This would allow much-needed refinement of risk assessment and further development of appropriate, independent mechanisms for monitoring and verification of mitigation practices.

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If for some reason this is not deemed possible, risk management needs to be conservative with regard to western gray whales (particularly females with calves in the nearshore foraging area) and their feeding habitat (occupied from June to November). Moreover, substantial monitoring efforts will be required to assess the effects of decisions about risk management on gray whales, with the understanding that subsequent modification of procedures may be required in response to the monitoring results.

SEIC did not provide a comprehensive, quantitative comparison of the three pipeline alternatives under consideration for transportation of oil and gas from the PA-A and PA-B platforms to shore. The 'base case' route poses additional risks because, among other things, it crosses the southern portion of the primary gray whale foraging area and is in close proximity to the mouth of Piltun Lagoon. The two proposed alternatives pass farther south and avoid that problem. Although all three proposed routes eliminate important risks associated with the Phase 1 FSO/tanker-based transportation system, each carries its own array of risks. The Panel identified four pipeline-associated risks: (1) noise and disturbance of whales during construction, (2) ship strikes during construction, (3) physical damage to benthic habitat during construction and (4) potential exposure of gray whales, their prey or ecologically important habitat (e.g. Piltun Lagoon) to oil spills and gas releases. Alternative 1 appears to be the safest with regard to the first three of those risks. It also provides an advantage with regard to the fourth risk in that any oil spills and gas releases would likely occur farther away from the Piltun (nearshore) feeding ground and Piltun Lagoon. A spill occurring in the east-west component of this alternative would: (1) take longer to reach the Piltun Lagoon and foraging area, thereby allowing more time for an effective response; (2) be more dispersed when it reached those areas, and therefore less likely deposit large amounts of oil in sensitive near-shore habitats; and (3) have lost a larger portion of its volatile components and therefore be less toxic to whales and their prey. The only obvious disadvantage of Alternative 1 appears to be that the probability of a leak or rupture would be increased somewhat due to its greater overall length.

The Panel's report provides a detailed review of the individual threats to gray whales and proposed mitigation and monitoring measures, as summarised below.

## **Review of individual threats and proposed measures**

### **Noise**

SEIC have invested substantial resources in trying to model the noise fields in the gray whale habitat in the vicinity of oil and gas activities. However, the Panel believes that their efforts have not yet proven successful, and determining to what degree noise will significantly affect western gray whales remains confounded by two major uncertainties: (1) the sound fields that gray whales will actually experience, which will be influenced by the whales' movements, characteristics of the sources, and sound propagation in shallow coastal waters; and (2) the hearing abilities of gray whales and their behavioural and physiological responses to different sound fields. Therefore, a reliable forecasting tool for assessing and managing the impacts of industrial noise on western gray whales is not available.

Noise levels will be greatest and most persistent during the construction phase of the project. Despite the uncertainties, given the almost complete spatial and temporal overlap between ongoing and planned development activities (including those of both Sakhalin I and II) and the feeding habitat used by gray whales off Sakhalin, the Panel concludes that the potentially significant threats from noise associated with Sakhalin II Phase 2 must be taken very seriously. SEIC documents err on the side of optimism in the face of uncertainty and lack specificity in their proposed mitigation measures. Every effort must be made to separate the development activities from the whales in space and time. Real-time monitoring of whale behaviour and habitat use in the presence (and absence) of measured noise levels and other characteristics is required as well as the development and following of strict criteria for the cessation of operations to prevent whales from being subject to high noise levels. The limitations of onboard observers, particularly in poor visibility conditions, also must be recognised.

### **Collisions/ship strikes**

Ship strikes can and do kill whales. Even if such events are rare, the modelling results show that if, due to any number of factors, only one female is killed per year the probability of extinction of the population is high. Although not quantifiable, the probability that ship strikes will contribute to such mortality will increase with the transition

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from Sakhalin II Phase 1 to Phase 2 simply because there will be more traffic and vessel activity associated with construction of the proposed PA-B platform and the platform-to-shore pipelines (as well as the traffic associated with Sakhalin I construction and operations). Although traffic in the vicinity of the nearshore feeding area should decrease with the end of construction and once the FSO/tanker-based transportation system has been replaced, a certain amount of vessel support will be required for the two Sakhalin II platforms over the long term. In addition, the risk of ship strikes on migrating gray whales at the southern end of Sakhalin Island will certainly increase as tankers begin moving oil and liquid natural gas from the new terminal at Prigorodnoye in Aniva Bay.

SEIC have described a number of mitigation measures to prevent ship strikes in the Piltun area, including closed areas around feeding habitat, speed limits or guidelines, onboard observers to detect whales and allow necessary speed and course changes, and partial curtailment of vessel activities at night or in inclement weather. The Panel is encouraged that SEIC recognise the potential for collisions and that they have prescribed mitigation measures. However, in the absence of necessary details on implementation and enforcement of these measures, the Panel is unable to judge their effectiveness.

Cautious vessel operation in the presence of whales is essential, but likely not sufficient because collisions often occur before the whale is observed. It is insufficient to rely on onboard observer programmes alone. Even if one assumes the observers are experienced and attentive, the ability to see whales is compromised in poor weather and sea conditions, reduced daylight etc. Clearly, measures that increase the likelihood of spatial separation of whales and ships (e.g. through the use of no-entrance zones, ship traffic lanes) are the most effective means of reducing the risk of ship strikes. Mandatory reductions in speed to specified levels (with even lower levels specified for nighttime and periods of restricted visibility) are also prudent in light of published evidence concerning ship strikes on other whales, including eastern gray whales.

### **Oil exposure**

The potential effects of oil on gray whales, either through direct exposure or through damage to their prey, are poorly known. Observations of the direct effects of oil on other marine mammals and the well-documented effects of oil on benthic invertebrates indicate that there is reason for serious concern. The consequences for gray whales of oil spills in the Sakhalin marine environment could vary from minor to catastrophic depending on the location, timing and size of the spill, the prevailing conditions and the ability of the benthos to recover. All available information indicates that western gray whales are almost completely dependent on benthic communities for feeding.

The Panel recognises that the oil spill risk from Sakhalin II will be reduced considerably by the transition from Phase 1 to Phase 2. Nevertheless, when viewed over the lifetime of the project, the risks of a spill during Phase 2 are considerable. For example, the probability of at least one blowout occurring at either platform over the 40-year project lifetime is about 3% and the probability of at least one pipeline spill could be as high as 24%, based on data provided in the CEA.

Spill trajectory modelling (in the CEA) revealed a high level of risk to the two gray whale foraging areas off Sakhalin even though the modelling did not consider worst-case scenarios involving platform blowouts and winter spills (under ice). A spill or release of oil in or near Piltun Lagoon also is a major concern because it could alter the ecological processes that maintain the Piltun (nearshore) foraging area where female gray whales nurse and wean their calves. This concern applies to both Sakhalin II and Sakhalin I, which includes plans for a pipeline crossing of the lagoon itself.

Given these concerns, the Panel believes that spill prevention is the key. Although the ability to respond rapidly to an oil spill is important, the overall efficacy of spill response in the face of a major spill is limited because of the conditions in which a large spill is most likely occur (e.g. severe ocean conditions, storms, winter, ice) and the remoteness of the platforms and pipelines from possible response centres.

Although the SEIC documentation on prevention and mitigation measures is extensive, the Panel found that a lack of specificity made it difficult to evaluate. Similarly, it proved difficult to evaluate some of the decisions taken (such as the location of the PA-B platform) in this context. Clearly, from the perspective of gray whale conservation, any reasonable means to reduce platform-associated risks to the feeding grounds, including moving the platform farther away from them, should be taken. Despite the information gaps, the Panel has made a number of general suggestions and comments on how spill risks could be further reduced (e.g. with respect to low-level leakage detection, rules for contractors, the oil spill response plan, the location of platforms and pipelines, the use of double-hulled tankers and the suspension of oil production at the PA-A platform until the pipeline is in place).

## Physical disturbance

As noted above, western gray whales appear to be completely dependent on benthic invertebrates to meet their annual energy requirements. Therefore, it is essential that their foraging areas off the eastern coast of Sakhalin Island remain unspoiled and productive. Physical disturbance of the seabed is unavoidable as part of offshore oil and gas development and therefore this aspect of Sakhalin II Phase 2 deserves close scrutiny. The Panel was disappointed at the relatively superficial consideration given to this issue by SEIC.

Apart from the potentially serious impacts of oil, benthic communities can be disrupted or transformed by physical removal (e.g. a patch of sandy plain becomes an elevated concrete platform), smothering with dredge spoil and other debris or alteration of nearshore current patterns and flows. In the present context, any disruption of exchange mechanisms between Piltun Lagoon and the Piltun (nearshore) foraging area is a special concern. Siting decisions, e.g. for platforms and pipelines, represent the most reliable avenue to mitigation of these effects. Therefore, in deciding where to install the PA-B platform and which pipeline configuration to use, it would have been appropriate to conduct a careful and detailed assessment of the associated risks to the integrity and productivity of the benthic communities on which gray whales depend, with particular attention to the biological and ecological processes that create the Piltun (nearshore) foraging area. This was not done. Instead, the risks of damage to gray whale feeding habitat from development activities were dismissed as insignificant.

## Information gaps and essential monitoring

Scientific investigations of the western gray whale population since 1995 have provided a remarkable amount of information regarding the population's abundance and composition (age/sex structure), reproduction, survival, condition, foraging patterns and behaviour on the feeding grounds. The available information provides a strong, albeit preliminary, basis for understanding the biology of these animals in their Sakhalin habitat and their potential vulnerability to oil and gas development. However, much remains to be learned through annual monitoring of the population and its habitat, and through directed studies into the potential effects of Sakhalin II Phase 2.

With regard to the potential effects of noise, collisions, oil and gas spills and habitat destruction, research and monitoring are needed to characterize both the risk factors and the dependent variables (i.e. whale, prey or habitat response). Due to uncertainty regarding potential effects and their detection, monitoring and research efforts will require careful and rigorous design to ensure that there is a high probability of detecting changes in demography that will have a significant effect on the recovery of the population. The Panel's review identified the following general areas for future research, including some that will require annual monitoring and some that will depend on circumstances (e.g. in the event of a spill):

- Continued, uninterrupted annual monitoring of important population parameters including abundance, trends, survival rates, reproductive rates and age (size)/sex structure. Analysis of the resultant time series of data may provide an early warning of problems within the population.
- Annual monitoring of gray whale foraging and habitat use patterns. The resultant time series of data may identify changes in habitat correlated with certain development activities.
- Real-time monitoring of behavioural and (if possible) physiological responses by the whales during periods when levels of underwater noise increase noticeably (e.g. during construction and seismic surveys).
- Recording and monitoring of whale/ship encounters (including strikes, near misses and safe avoidance) to determine if adjustments are needed to vessel traffic based on ship size, location, speed, daylight, or other pertinent variables.
- Surveys at regular intervals during the open-water season along the eastern Sakhalin coast to detect stranded gray whales (or floating carcasses), coupled with a serious effort to investigate cause of death in the event of finding a dead gray whale.
- Investigation of the ocean dynamics (currents, tides, winds) in the vicinity of Sakhalin II, the Piltun (nearshore) and offshore feeding habitats, and the Piltun Lagoon; *inter alia* this will allow for better modelling of the dynamics of oil spills and improved response strategies.
- Investigation of the ecology of Piltun Lagoon and the nearshore foraging area, and the links between them; *inter alia* this will provide a more secure basis for evaluating the likely risks to gray whales and their prey and better inform decisions on siting pipelines and other infrastructure and activities.

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- Investigation of the biomass, distribution and ecology of gray whale prey populations and the effects of oil on them.
- If one or more spills occur, investigation of (1) any direct, acute effects of oil and gas on whales and their prey, and (2) the effects of chronic exposure should spilled oil remain present for a prolonged period.
- Periodic monitoring of contaminant levels in the habitats exposed to potential (and actual, should they occur) leaks and spills.

## **The need for a comprehensive strategy to save western gray whales and their habitat**

The Panel's review focused on just one of a number of major oil and gas development initiatives around Sakhalin Island. Importantly, threats to the western gray whale population do not arise solely from oil and gas development, nor are they limited to the Sakhalin region. Further, the threats do not occur in isolation but rather they are cumulative. Most, if not all, western gray whales spend approximately half the year elsewhere in eastern Asia, passing through waters within the EEZs of Japan, the Republic of Korea, the Democratic People's Republic of Korea, and China. Development and use of marine resources throughout the range of these whales, including but not limited to offshore oil and gas, involves a wide array of financial interests and technical support from Russia and other countries in eastern Asia, North America and Europe.

Previous analyses and expressions of concern by major international bodies such as the IWC and the 3<sup>rd</sup> World Conservation Congress have made it clear that there is serious, widespread interest in the issue of western gray whales and Sakhalin oil and gas development. The Russian stake in western gray whale conservation is clear, given that the entire population apparently derives almost all of its annual sustenance from waters within the Russian EEZ. Nonetheless, a number of other countries will play direct and potentially decisive roles in determining the fate of the population.

A comprehensive, international strategy (including research) is essential for saving this whale population. The Panel recognised the need for a comprehensive strategy that addressed not only oil and gas development, but also other threats to the population. The results of population modelling (Chapter VII) showed that quite small impacts on the animals or their habitat, if they are persistent, could lead to the population's extinction. A piecemeal approach, based on assessment of the impacts of one development project at a time, will not adequately address the western gray whale conservation problem, because the accumulated total of impacts may prevent recovery of the population even if the impact of each project can be limited to apparently acceptable levels. The survival of the population cannot be assured without a protection regime for the nearshore feeding habitat, aimed at limiting the combined impact of all current and future developments (including but not limited to oil and gas developments) on this habitat and the whales feeding there.

Although the subject of a comprehensive strategy was outside the Panel's terms of reference and therefore no attempt was made to develop it, this report may provide at least a partial basis for development and oversight of such a strategy by an independent international organization. In this context, we note and commend the ongoing regular reviews of population status and research needs of western gray whales by the IWC's Scientific Committee, as well as the less regular but important consideration of these matters by the Russian Group for Strategic Planning of Gray Whale Research and the IUCN Species Survival Commission's Cetacean Specialist Group. These bodies may provide the foundation for a comprehensive strategy that includes strong international, independent planning and oversight.