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Arctic Oiled Wildlife Response: Exploring Potential and Limitations

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ABSTRACT 299924 :

The Arctic is an extremely vulnerable area for oil pollution. Because of global warming and the resulting retreating ice, new economic shipping and Exploration & Production activities are likely to develop in the coming years and decades. Both governments (e.g. Arctic Council) and the oil industry (e.g. Arctic Response Technology Joint Industry Programme) are preparing for increased oil spill response capabilities in the Arctic region, and are looking to join forces for more efficiency and effectiveness.

In connection to oil spill response planning in the Arctic both onshore and offshore, attention should be given to oiled wildlife response preparedness in this region. The Arctic is characterized by unique ecosystems and biodiversity, either marine or terrestrial, with a large proportion of migratory species. So although species diversity is assumed to be low compared to other regions, Arctic wildlife is very sensitive to the effects of oil pollution. Additionally the Arctic is a remote and extreme area for setting up a wildlife response in the framework of an oil spill response.

This paper explores what the limitations of an Arctic oiled wildlife response would be (physical/logistical, health & safety, environmental monitoring, ecosystems understanding, biodiversity data, sensitivity mapping, etc.), and identifies how current gaps in response preparedness could be filled. Special emphasis is laid on investments into the capabilities of specialised responders and their equipment, including creation of a specialised Arctic Wildlife Response Strike Team.

INTRODUCTION:

The Arctic region is an area of extreme environmental conditions and a unique habitat for species that have adapted to these conditions. The marine food chain is shorter than anywhere else in the world, with only a few steps (trophic levels) between algae production and top predators. With the retreating ice that has been observed over the last few decades (with a reported maximum retreat during summer 2012), some of the formerly inaccessible economic potential of the Arctic is now likely to come within reach and be developed. This may include the exploitation of potentially considerable gas and oil reserves and the opening of new and shorter shipping routes north of the continents (see Figure 1).

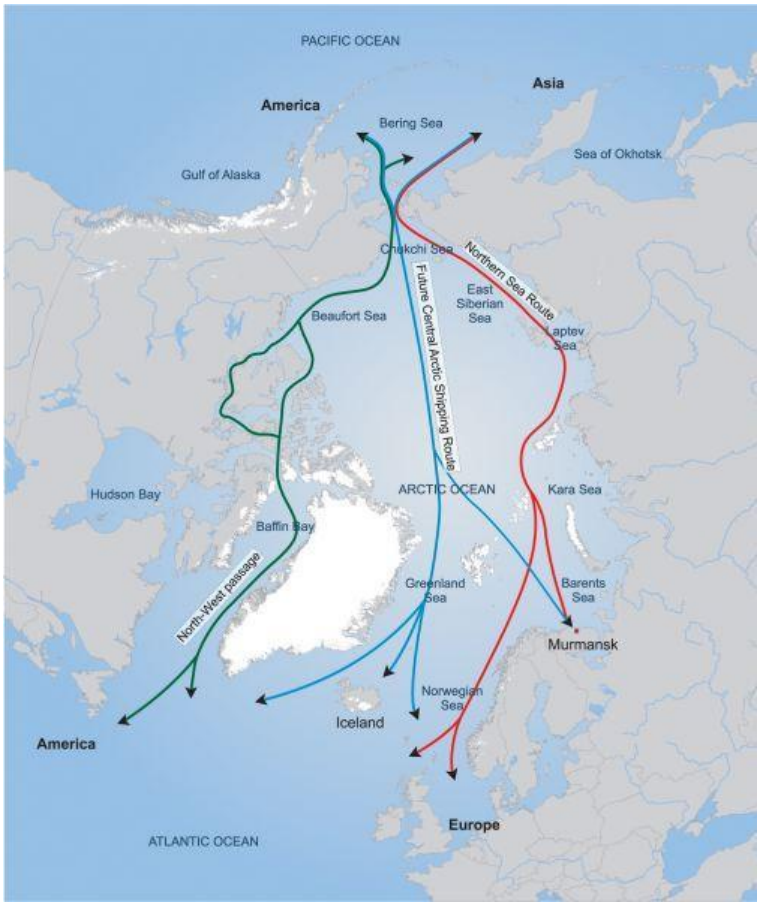

Figure 1: Map of possible shipping routes in the Arctic (source: NATO Parliamentary Assembly, 2010.)

The development of new economic activities in the Arctic will lead to increased primary and secondary risks of oil pollution. Primary risks are connected to e.g. exploration and production (E&P) activities and the presence of an increasing number of commercial vessels in the area. Secondary risks are connected with the supply needs in support of these developments, such as new infrastructure (harbours, equipment stockpiles, pipe lines, roads, shipping routes) and new human settlements (see Figure 2).

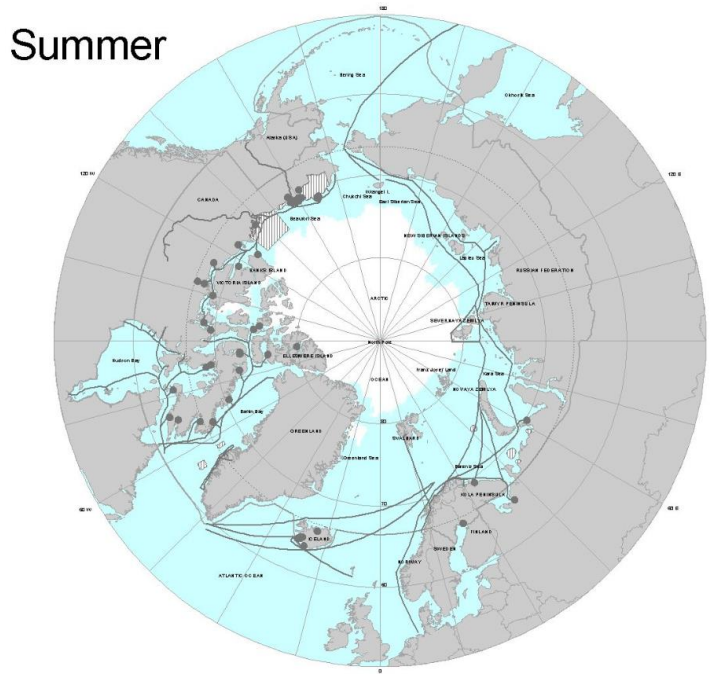

Figure 2: Map of potential pollution sources (Source: EPPR-Arctic Council, 2002). Dots: storage terminals and production areas. Grey lines: transport routes. Hatched areas: exploration or production area.

In 1996 the Arctic Council was established by the circumpolar countries to govern the area. The Council in recent years gained significant importance when the new economic resources became apparent. In 2011 an international agreement ("Aeronautical and Maritime Search and Rescue in the Arctic") was signed which deals with search and rescue of aeronautical and maritime vessels and passengers (see Figure 3). In May 2013, the Council adopted a second binding agreement that will allow for joint coordinated action between states to combat the consequences of an oil spill in the region. The agreement sets out guidelines e.g. communicating between countries, coordinating personnel and the division of tasks.

Due to local specificities (ecosystem sensitivity, climate, remoteness), an oil spill in the Arctic would have higher consequences for the environment than in other areas; therefore oil spill risk reduction is mainly driven by preventive measures. However mitigation measures are also considered and organized through the oil spill contingency plans developed by the oil and gas industry. In this respect, the industry has created working groups and task forces (in particular the Arctic Response Technology Joint Industry Programme for oil spill preparedness, managed by the International Association of Oil and Gas Producers - OGP) that are charged with identifying spill risks and studying oil spill response methodologies and technologies that can be used in the remote and extreme Arctic (Arctic Response Technology, 2013). These studies will, in the end, direct the development of special response capacity and common resources to mitigate the risks of pollution in a worst case scenario.

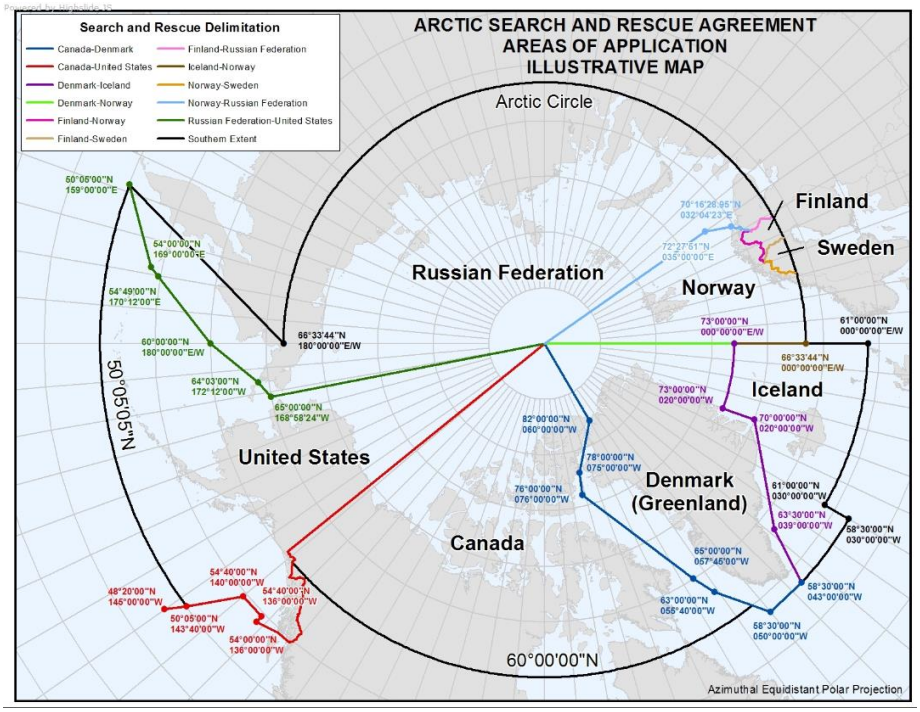

Figure 3: Zones of international responsibility for search and rescue (SAR) purposes, as defined by the 2011 International Agreement "Aeronautical and Maritime Search and Rescue in the Arctic" (Source: http://library.arcticportal.org)

So far the risk of wildlife incidents as a specific component of Arctic oil spill response preparedness has received little attention. This paper summarises the results of a desktop study which is aimed at:

- Providing an overview of which wildlife issues might be at stake (species, response capabilities)
- Assessing which gaps need to be filled in the near future in order to achieve an appropriate level of industry preparedness for Arctic oiled wildlife response.

DEFINITION OF ARCTIC WILDLIFE RESPONSE:

Defining "Arctic"

The US National Snow and Ice Data Centre (NSIDC, 2013) provide the following definition on what the Arctic is:

The Arctic consists of ocean surrounded by continental land masses and islands. The central Arctic Ocean is ice-covered year-round, and snow and ice are present on land for most of the year. The southern limit of the arctic region is commonly placed at the Arctic Circle (latitude 66 degrees, 32 minutes North). The Arctic Circle is an imaginary line that marks the latitude above which the sun does not set on the day of the summer solstice (usually 21 June) and does not rise on the day of the winter solstice (usually 21 December). North of this latitude, periods of continuous daylight or night last up to six months at the North Pole.
Arctic researchers also define the Arctic region as:

- The area north of the treeline (the northern limit of upright tree growth)
- Locations in high latitudes where the average daily summer temperature does not rise above 10^0C.
- Permafrost limits are variable dependent on percentage and depth of permafrost present (NSIDC).

The following map (Figure 4) shows multiple definitions of the Arctic: the tree line; the 10 degrees Celsius isotherm, the marine boundary, the High Arctic, the subarctic, and the Arctic Circle, as well as the region covered by the AMAP programme (Arctic Monitoring and Assessment Programme - AMAP is an international organization established in 1991 to implement components of the Arctic Environmental Protection Strategy - AEPS).

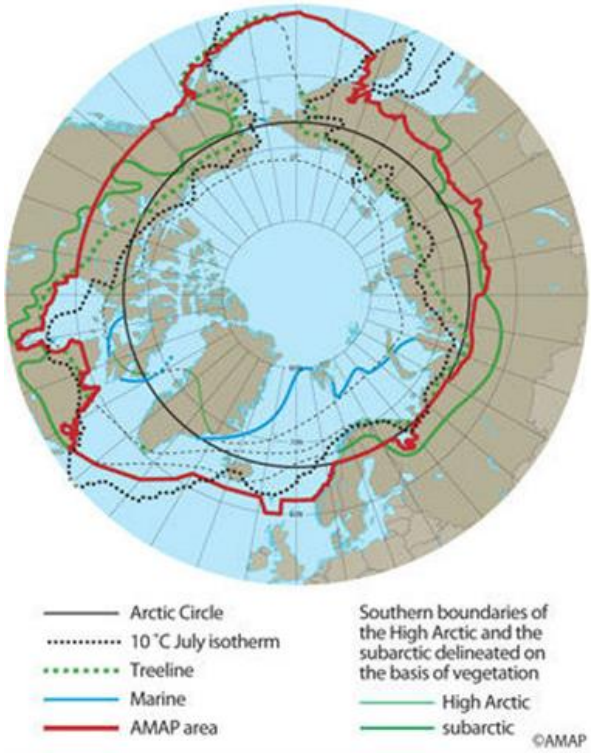

Figure 4: Various definitions of the Arctic (AMAP).

Defining Arctic wildlife response

Oiled wildlife response includes activities to prevent or mitigate the effects of oiling of wildlife. Defining Arctic wildlife response as a wildlife response north of 66’32” would be a too limited approach. It is defined for the purpose of this report as a wildlife response in areas north and south of the Arctic Circle where during considerable periods of the year (particularly from autumn to spring) severe Arctic climatologic and environmental circumstances may limit the number of wildlife response options that can be considered and applied. These circumstances would include:

- Long periods of (extreme) frost, leading to
- Ice coverage of the sea surface for weeks to months
- Snowfall and a persistent thick snow cover of land, coast and infrastructure
- Extremely short periods (few hours) of daylight.
- Unpredictable and sudden weather changes
- Sensitive soils (e.g. tundra, permafrost layers subject to thawing) that could be impacted by response and/or create access problems.
- Remoteness.

WILDLIFE RESPONSE OPTIONS:

Under normal circumstances a wildlife response has a wide array of options that can be considered to prevent or mitigate effects of oil on wildlife:

- Prevent the effects of oil on wildlife
  - Contain and recover oil before it affects wildlife. Wildlife response via:
    - The use of updated and detailed seasonal sensitivity maps (map for each month)
    - Real time monitoring (ensure the relative whereabouts of wildlife in relation to the whereabouts of oil)
    - Biological strategic advice from a biologist who can provide guidance in regard to expectations of developments (where/when animals are likely to be moving into or out of danger) in the days and weeks to come (combining real time monitoring data with the details of sensitivity maps and migration patterns)
  - Remove animals before oil hits their habitats
    - Hazing/deterrence (scaring animals away from the oil or from threatened habitats).
    - Pre-emptive capture/collection. Captured animals are kept in captivity until they can be released in a clean(ed) environment. Also nests or eggs may be collected and relocated elsewhere or, in the case of eggs, hatched artificially.
  - Prevent secondary pollution
    - Remove oiled animals from the environment (prevent scavenging and distribution of oil in the food chain); prevent live oiled animals spreading oil into unoiled areas.
- Mitigate the effects of oil on wildlife
  - Deal with live casualties
    - Rehabilitate casualties (capture, stabilise, clean, recondition and release). Rehabilitation is a technically demanding operation for which many elements should be in place in order to be successful. Animals are temporarily taken out of their natural environment, treated and released in an improved body condition. Post release survival studies are needed to monitor and test the success of the operations.
    - Euthanise casualties (if rehabilitation is not an option, e.g. because the animal is too weak, or the capability for rehabilitation is limited). Humane methods need to be used to minimise the suffering of animals that cannot be rescued. For some methods animals need to be captured, for others (shooting) capture is not necessary, but disturbance of other animals may be an issue. Corpses of euthanised animals need to be collected and disposed of (as polluted waste). It is important to note that the euthanasia of animals may be controversial in cases where the public expects them to be rescued and rehabilitated (see section 5).
    - Dealing with stranded marine mammals – rescue and rehabilitation of a live stranded animal would only be feasible if a suitable facility that can handle a large animal is located within a reasonable distance, as well as having suitably qualified persons and equipment for handling and transport. Euthanasia protocols should be defined in cases where an animal cannot be rescued or rehabilitated. If an animal strands alive in an area where the public are able to see or access it, a communication strategy

should be in place to inform the public about measures being taken and to form an exclusion zone around the affected animal.

- Assess impact. Ensure the assessment of oil impact on populations via scientifically reliable methodology for collection and analysis (e.g. effort registered collection, necropsy, biometry).

These options and methods for wildlife response have been developed in geographic regions where oil spills regularly occur. Whether they can be used at the same level of effectiveness under Arctic circumstances will depend on some obvious limitations that are to be expected in these circumstances.

ARCTIC LIMITATIONS FOR WILDLIFE RESPONSE:

Limitations for oiled wildlife response under Arctic circumstances would closely correlate with the following factors:

- Extreme cold that would reduce the chances for survival of oil affected wildlife. Losing the insulating capacity of feathers or fur after coming into contact with oil will mean that animals will quickly suffer from severe hypothermia. This reduces the window of opportunity that responders have to capture and stabilise casualties.
- Extreme climatological and environmental conditions that would threaten and affect the health and safety of responders (extreme cold, working in/near ice, lack of medical facilities etc.)
- Remoteness, more specifically the absence of
  - Basic resources
    - Trained work forces for wildlife response (tier 1, tier 2, tier 3 responders) and their equipment
    - Existing animal care facilities (large spaces to keep animals and people comfortably away from harsh weather and climate conditions, where electricity, water is sufficiently and continuously available)
    - Supplies for operations (food and basic necessities for staff/volunteers)
  - Bases where expert wildlife responders can stay and work from, e.g. field stations with accommodation and basic amenities
  - Reliable infrastructure (roads, airports, harbours, etc) that can be kept ice and snow free, or at least controlled, that allow quick and efficient transport of responders and animals between the affected areas and facilities.
- Short working days for field activities (or absence of daylight in winter)
- Ice and snow conditions that prevent expert responders from safely reaching oil affected areas where field activities need to be carried out
- Ice, snow, sensitive soils and spatial conditions that do not allow expert responders to approach and deal with individual animal casualties (e.g. animals that will spread out or hide in inaccessible areas)
- The occurrence of dangerous predators that may put responders at risk (e.g. polar bears)
- Fast changing weather conditions, e.g. occurrence of polar lows and Arctic mist that reduce visibility and create problems for transportation.

Compared to non-arctic conditions, these limitations may lead to a wildlife response that might be successful on a smaller scale (e.g. fewer animals that can be prevented from oiling, lower number of live animals rescued and successfully rehabilitated, fewer oil affected

corpses that can be recovered from the environment), or may not be possible at all. This may not meet the public expectations of what the success of an Arctic wildlife response should be.

MEETING PUBLIC EXPECTATIONS:

The oiling of animals in their natural environment and the arrival of oiled animals on the shoreline is not something that happens every day and it can be perceived as dramatic by the public, whenever it happens, in particular when images of oiled animals are used by the media to draw the attention to the impacts of the spill on the environment.

Although public emotions do not always provide the best guidelines for managing a response, the public would expect an effective response to any oil spill that happens. For the incident response organisation, especially during the planning phase, it is important to be aware of a demanding public and the role of media in affecting the public image of the response. Figure 5 illustrates that a battle will take place on two fronts.

Public opinion and media impact will particularly be at stake if oil is spilled in the Arctic. The Arctic is broadly considered one of the last unaffected wild places and the public perception is that its pristine qualities, including its wildlife, need to be safeguarded.

The public will measure the quality of the response as a function of the perception created by the media. It is therefore crucially important that the media immediately can be provided with reliable information on what is happening and why, and with material from which it is obvious that the mobilised response is professional and effective.

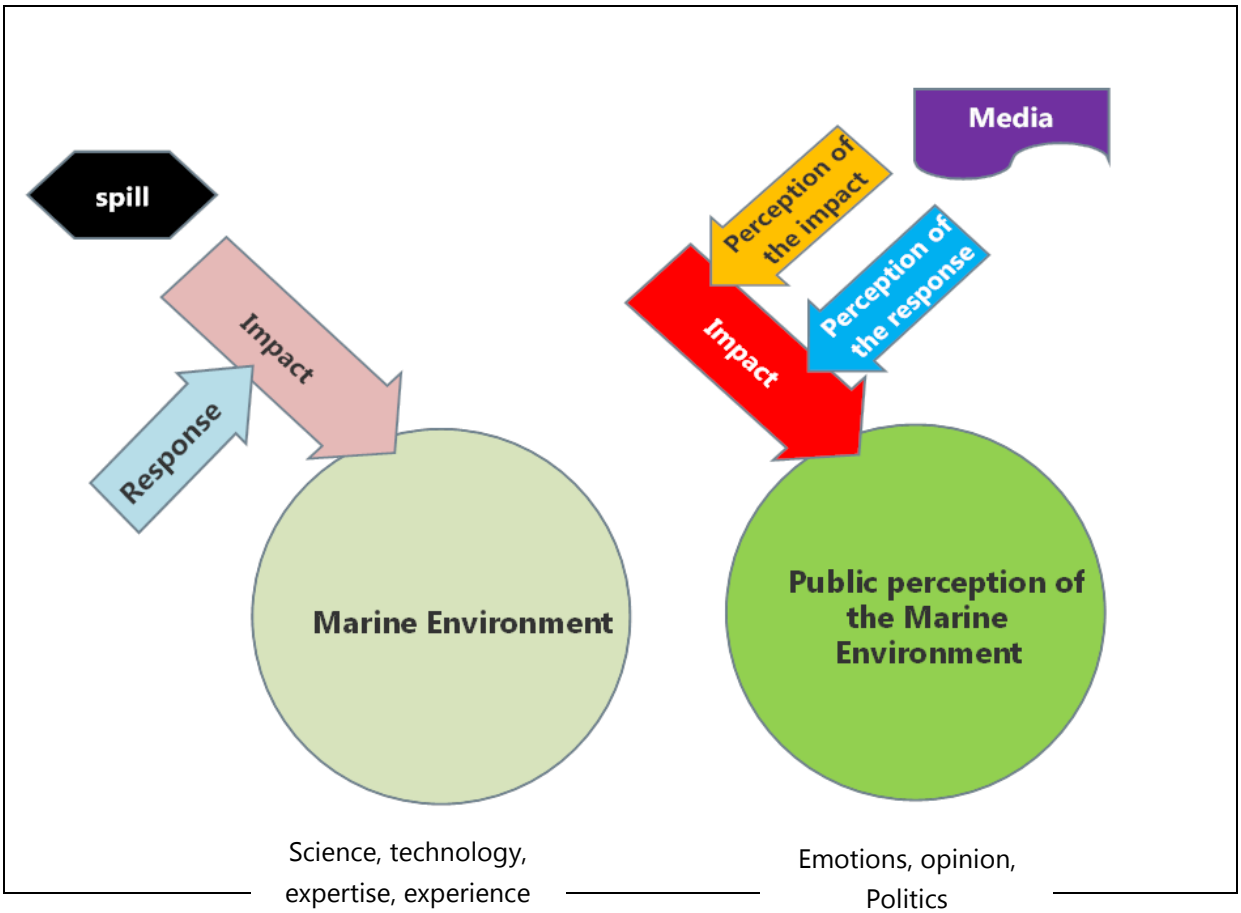

Figure 5: Two battles have to be won during an oil spill response. Whereas the media and the general public are difficult to engage in the planning phase, they are the most critical observers of a wildlife response. Nowadays in many societies opinion leaders can use social media to quickly mobilise thousands of supporters, the effects of which are difficult to ignore if strong viewpoints are developed against the course of action in the response and the way the response is managed. Where the professional oil spill responder traditionally concentrates on the technical aspects of combatting oil (left image), the virtual battle on perceptions (right image) is often overseen in the planning phase and easily lost during a real-time incident.

MODEL FOR ARCTIC WILDLIFE RESPONSE PREPAREDNESS:

Description of the model

In dealing with the challenges of an extreme and potentially hostile environment for wildlife response and considering rehabilitation and euthanasia as potential wildlife response strategies, the model as in Figure 6 can be used. This reflects (on the X-axis) an Arctic gradient from south to north where the environmental conditions become more extreme, areas become more remote and potentially dangerous/hostile for humans to work in. On the Y-axis is reflected that a wildlife response can have three basic options for intervention in case of live oiled animals (max 100%):

i) no active intervention, basically monitoring and leaving the animals in their natural environment where they most likely will die from oiling
ii) an active intervention from the perspective that animals cannot be rescued, but need to be assisted (euthanasia) from an animal welfare point of view
iii) an active intervention from the perspective that animals can be rescued and rehabilitated, because the specific circumstances and logistics allow for a complete chain of capture, transport, stabilisation, washing, waterproofing and release to be successfully completed

Because option iii) is the most demanding in terms of preparedness and a logistics burden, it can only take place under relatively ideal conditions. Option ii) can still take place under conditions that are not favourable for rehabilitation, but it is limited to places in which humans can work without compromising their health and safety.

It should be noted from Figure 6 that even under optimal conditions where rehabilitation can take place, it will not be an exclusive response option: it will always go hand in hand with euthanasia (ending the suffering of animals that cannot be rescued). The fact that some animals will die at sea before they can be rescued must also be considered.

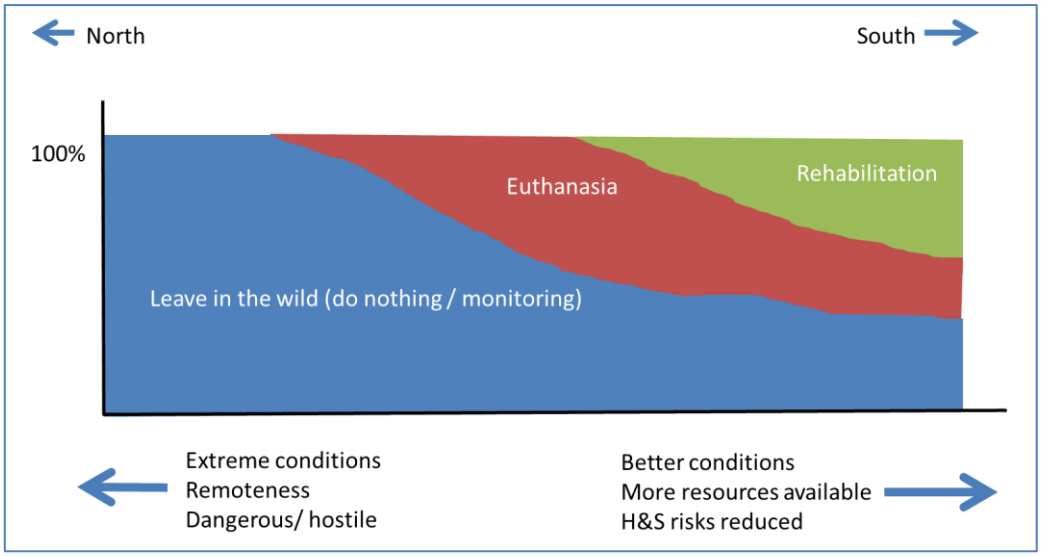

Figure 6: Model for dealing with live animals under Arctic conditions. Note that the model is conceptual and here presented on a north-south gradient at a global scale. However the model could also apply on a more local scale, and on other gradients, but taking into account local conditions (e.g. nearshore-offshore, human settlements-remote, wildlife species groups, seasons, climatic & metocean factors, etc.).

Challenging boundaries

The model says that going north, the option to consider rehabilitation will be fading out first. Going further north, at some point humans cannot safely approach animals any longer to administer euthanasia. That point determines the absolute limit of an active wildlife response intervention, and leaves option i) (do nothing/monitoring) as the only one that can be considered. Towards spring and summer, the boundaries may move upward again, allowing wildlife response activities in areas that would not be considered during winter. Theoretically there are two ways to challenge these boundaries:

1. Capturing animals under relatively remote conditions, and transporting them over sometimes considerable distances to a location where a rehabilitation effort can be comfortably set up and sustained, and bringing them back to their habitat, or transporting them to a suitable, equivalent habitat for release.
2. Setting up a self-supporting mobile rehabilitation unit in an area that does not naturally support these efforts, which requires a well organised and planned operation that is fully dependent on high level logistic preparations.

In the recent past both methods have been applied, for instance in the Selendang Ayu incident (2004) where live oiled birds caught on Unalaska Island were air-transported to a turn-key rehabilitation facility in Anchorage where they were rehabilitated. Following the grounding of the MS Oliva on Tristan da Cunha (2011), a vessel with a response team and equipment sailed from South Africa in order to set up and run a temporary rehabilitation facility in extreme isolation, together with the local inhabitants.

Putting the model into practice: wildlife response planning

The model can be put into practice via country or region specific oiled wildlife response plans. The planning process starts with mapping the sensitivities (geographical, seasonal distribution of vulnerable species) and assessing the risk of oiling. An assessment of local preparedness (expertise, trained work forces, equipment, facilities), and determination of the legal and policy requirements for a response (via the local authorities) will further provide ingredients for developing the objectives and strategy of the plan. The model can be

used to define the geographical and physical limits of the different response options, by determining how these options can be realised by local and/or international resources, in consideration of seasons, local topography/geography, available infrastructure and other relevant variables.

Offshore, nearshore and onshore aspects of planning

Oil spills can be caused by different sources and can happen offshore, nearshore or onshore. The potential source of a spill and its distance to the shoreline are important factors to take into account in wildlife response planning. Apart from natural seeps of oil, oil releases into the marine environment are caused by human activities and the highest risks are connected to shipping, exploration & production. Whereas the risk of shipping incidents remains high (the frequency of reported incidents is not decreasing, although the frequency of tanker spills has seriously declined – ITOPF, 2012), each individual ship has a limited volume on oil on board. Although the frequency of reported blowouts from E&P activities is much lower, the 2010 Macondo incident demonstrates that potentially unlimited volumes of oil may be released from a well into the environment until the well is capped. However, it should be noted that this accident has led to specific arctic developments to reduce the risk of loss of containment due to blow out, such as the drilling capping system, use of relief wells, etc.).

Because oil quickly spreads on and in water, an oil spill in the marine/aquatic environment can be more devastating to environmental, economic and social values than an onshore (terrestrial) spill, from which the oil will not spread far from the source. The exception is a riverine or estuarine spill where, if not contained, the contamination can spread up or downstream potentially over a large area due to fluvial or tidal influence. Depending on the type of oil in relation to the ambient water temperature and salinity, in most cases of a marine spill, oil will float on the water surface. Movements of weathering oil are predominantly depending on currents and to a much smaller amount on winds. As a rule of thumb, direction of oil movement is calculated as the resultant of 100% current speed and direction and 3% wind speed and direction (ITOPF, 2013). A spill from a deep sea well will cause a pelagic plume (and disperse) in the water column, travelling with the tides before a part of the oil may appear at the sea surface and become exposed to wind and follow wind direction.

Wildlife that becomes affected by oil at sea while still alive will not necessarily stay in the slick. Debilitated birds may swim away from the oil and might make it to the nearest coast, assisted by onshore winds. If distances are too far however, and/or winds are blowing offshore, oiled animals may die before reaching the coast, and never be found on the coastline. In other words, nearshore spills may cause many live animals arriving on the coast, especially if prevailing winds blow them onshore. Animals oiled far offshore may not make it to the nearest coast, even if prevailing winds blow onshore. The oil itself however may travel vast distances and surface closer to shore, and may cause the oiling of wildlife along hundreds of kilometres of shoreline. This was evident in Macondo, but also in the *Erika* (1999) and *Prestige* (2002) spills, where the oil tankers broke in the open ocean far from the shore.

In colder water temperatures, oil may behave differently. Oils below their pour point may become semi-solid at lower temperatures. In ice conditions, the behaviour of spilled oil will also be heavily dependent on the timing of the spill and the type of ice which is present. Oil can be contained by ice because it creates a natural barrier to oil movement, or if oil is

spilled under a solid sheet of ice, it can spread laterally and may re-surface at some distance from the original spill site during the next melt period (Nuka, 2010; Singsaas and Lewis, 2011).

A terrestrial oil spill (e.g. broken pipe line) or oil surfacing operations (tar sands), will cause surface pollution in a limited geographical area only. This will allow hazing and deterrence to be considered as more useful and effective wildlife response options, and cause relatively fewer casualties in a confined search and rescue area. The diversity of terrestrial species affected may however be larger, potentially challenging the rehabilitation process as species may be admitted into a rehabilitation centre for which no protocols have been developed.

CREATING THE ABILITY TO RESPOND UNDER ARCTIC CONDITIONS: OVERVIEW OF NEEDS

Overcoming some of the obvious limitations of Arctic wildlife response would need an investment into the following areas:

- Training programme for wildlife responders to work under Arctic conditions
- PPE suitable for arctic conditions (Arctic PPE is still the subject of on-going R&D)
- Specialised arctic wildlife response equipment
- Specialised arctic mobile equipment units and facility design/logistics guidelines
- Specialised means of transport for field monitoring and response activities
- Survey and analysis of different Arctic areas at risk
- Strategies for
    - Setting up a well-equipped self-supporting response base that can respond autonomously for a defined period under extreme Arctic circumstances
    - Transporting captured animals to locations where their rehabilitation can be undertaken under easier circumstances
    - Euthanizing animals in the field to reduce their suffering, if their successful rescue and rehabilitation cannot be achieved
    - Communicating with the public on the limitations of Arctic wildlife response, e.g. via a pre-spill developed website that goes live at the time of a mobilised incident response (see section 5)
- Where needed, monitoring programmes to provide better baseline data on distribution and behaviour of arctic marine wildlife species at risk of becoming oiled.

A pre-spill investment into the development of specific training programmes, equipment and management tools is likely to increase the ability of wildlife responders to respond safely and effectively under Arctic circumstances. This will also help to better manage expectations with stakeholders and the wider public.

CONCLUSIONS:

The Arctic is an extremely vulnerable area for oil pollution. Because of global warming and the resulting retreating ice, new economic shipping and E&P activities are likely to develop in the coming years and decades. Both governments (e.g. Arctic Council) and the oil industry are preparing for increased oil spill response capabilities in the Arctic region, and are looking to join forces for more efficiency and effectiveness. This is why Total's Exploration & Production strategy in the Arctic is based on a step-by-step approach and currently mainly focused on gas prospects, especially in offshore contexts. So far

preparedness for oiled wildlife response in the Arctic has not received a lot of attention. But the threats to birds and mammals in the area are considerable and should not be underestimated.

The capability of the world's most experienced oiled wildlife responders to respond in the Arctic is limited. Although they are well trained and experienced to deal with oiled wildlife casualties in their home countries and in many places across the world, their current training and exercises do not include Arctic modules. In other words, a dedicated Tier-3 capability for Arctic wildlife response is currently lacking and certainly not robust. Also it has not been studied if dedicated equipment kits and facility modules (mobile units) should be developed for Arctic wildlife response.

Therefore it is proposed that the oil industry considers collectively investing into the activities an Arctic Oiled Wildlife Response Task Force that will deliver:

- A high level oiled wildlife response plan for the Arctic region, specifying (in terms of seasons, ice, snow and permafrost conditions, offshore near-shore and onshore):
    - The availability and limits of various response options (rehabilitation, euthanasia, hazing and deterrence)
    - An overview of existing rehabilitation protocols for the most vulnerable species in the region (marine, coastal, terrestrial)
    - An overview of hazing and deterrence methods that can be used in the Arctic
    - Equipment and facility needs
- Recommendations on incorporating dedicated Wildlife Response Plans into oil spill contingency plans which are mandatory for any oil and gas exploration & production activity. The authors consider that oil exploration and production activity in the Arctic must involve pre-spill development of specialised capacities to protect the environment and mitigate damage (including wildlife) from any possible oil spill impacts.
- A proposal for a specialised Arctic Wildlife Response Strike Team, preferably under the umbrella of an international oil spill response organisation and incorporating leading international wildlife response organisations, which should be made available to industry and government or other end-users. Such a proposal should describe the size of and functions of a Strike Team, their training and exercise requirements, as well as training and exercise requirements for in-country Tier 1 personnel.
- Analysis of wildlife species concerned and risks associated for each of them.
- Recommendations for establishing an Arctic wildlife response equipment stockpile, especially if the existing government/industry wildlife equipment stockpiles are not considered as suitable for use in the Arctic.
- Recommendations on the feasibility and set up of mobile units for stabilisation and/or rehabilitation (including ship based modules) that can be used in the Arctic.
- Recommendations on filling data gaps for arctic species (e.g. where distribution and abundance are poorly known) through additional monitoring, in a format and level of detail suitable for oiled wildlife preparedness and response purposes.
- An international Arctic oiled wildlife response and preparedness workshop to which NGOs and interested authorities from circumpolar states will be invited, with the aim to discuss the various issues of oiled wildlife preparedness in the Arctic, and creating a basis for Authority-NGO-industry partnerships to develop appropriate levels of tiered response preparedness in the region.

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