Québec’s first contingency plan for oiled wild birds was set up by the federal government and the oil industry in 1985. A bird of prey rehabilitation programme was initiated at the College of Veterinary Medicine, Université de Montréal, in 1987. In 1993, we were approached by a federal governmental agency (Environment Canada) to manage all oiled bird aspects of the contingency plan. In 1999, 49 tonnes of fuel were spilled near Havre-Saint-Pierre in the St. Lawrence seaway. Over 1,000 birds (mainly common eiders, Somateria mollissima) were affected even with such a relatively small oil spill. After this major event, strategies and planning were reviewed with the assistance of the international community of oiled wildlife rehabilitators to improve the preparedness and efficiency for future responses.

The St. Lawrence Seaway includes the St. Lawrence Gulf, Estuary and River (Figure 15.1 and Chapter 11), a huge body of water about 1,700 km long. The coastline represents more than 4,300 km and is a difficult area to navigate. Officers of most ships are assisted by an experienced pilot when entering this seaway. About 3,000 ships navigate through the Seaway every year. Nearly 24 million tonnes of oil in cargo and 9 million tonnes of propulsion fuel are moved in the seaway annually. Nearly 50 oil spills occur annually along the St. Lawrence River.

Figure 15.1. The St. Lawrence Gulf, Estuary and River.
but only one or two involve large deployment logistics. Wildlife is rarely involved.

Depending on the season, however, 200,000 to 1,000,000 birds of 129 species are present along the St. Lawrence River, Estuary and Gulf. At times, the concentration of birds can be important in a given area and even a minor spill could have a major impact if occurring in such an area. For instance in the autumn, Cap Tourmente, near Québec City, can harbour over 200,000 snow geese (*Chen caerulescens*). In addition, the season of occurrence is crucial. In cold water and weather in winter, the mortality of oiled birds is higher even in the presence of a minimal amount of oil on the plumage.

For an efficient response to a crisis, preparedness plays a major role. Managing the event needs a multi-disciplinary approach; it needs among others an army-like ‘incident command system’. Then comes the expertise of different organisations and their networking. Tables 15.1 and 15.2 describe the involvement of different local and international organisations. Some organisations offer training opportunities.

### Oil Spill Response in Quebec

#### 1) Spill Detection

Spill events are first communicated to Environment Canada and the Canadian Coast Guard. A sequence of actions is initiated including: contacts with the responsible party and the ship insurances, chemical and toxicity tests on the product spilled and contacts with responders.

The oil source may be unknown. ‘Mystery’ offshore oil spills have been responsible for the death of more than 300,000 sea birds annually in international seas near Newfoundland, Canada (Wiese and Robertson, 2004). The same authors developed a general mathematical Oiled Seabird Mortality Model (OSMM) to assess seabird mortality due to chronic oil pollution. The south of Newfoundland provides food to near tens of millions of seabirds year-round and is among the highest oil polluted area in the world, just at the entrance of the St. Lawrence Gulf.

Subsequently to those studies and to non-governmental pressure, in 2005, the Canadian Government adopted bill C-15, an act to amend the Migratory Birds Convention Act and the Canadian Environmental Protection Act against the dumping of oily bilge wastes, or other pol-

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### Table 15.1. National organisations involved during an oil spill along the St. Lawrence Estuary and Gulf.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Function related to wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Canadian Coast Guard</strong></td>
<td>Governmental (federal agency)</td>
<td>Major role in incident command system (ICS); regulation; interaction with the party responsible</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.ccg-gcc.gc.ca/eng/CCG/Environmental_Response">http://www.ccg-gcc.gc.ca/eng/CCG/Environmental_Response</a></td>
<td></td>
</tr>
<tr>
<td><strong>Canadian Wildlife Service (Environment Canada)</strong></td>
<td>Governmental (federal agency)</td>
<td>Major role in ICS, bird surveys, modelling bird population impact, recommendations on intervention</td>
</tr>
<tr>
<td><strong>Eastern Canada Response Corporation Ltd (ECRC)</strong></td>
<td>private corporation</td>
<td>Interaction with the party responsible; coordination of field operations (pumping, haz- ing buoys, shore cleaning); major role in ICS; facilitator with capture and rehabilitation of birds</td>
</tr>
<tr>
<td><strong>Fondation Les Oiseleurs du Québec</strong></td>
<td>private non-profit organization</td>
<td>Sub-contractor under ECRC; role in ICS; bird surveys; bird hazing; bird capture; coordination of the rehabilitation centre</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.oiseleurs.ca/ang/index.html">http://www.oiseleurs.ca/ang/index.html</a></td>
<td></td>
</tr>
<tr>
<td><strong>Centre québécois sur la santé des animaux sauvages</strong></td>
<td>Veterinary College, Université de Montréal</td>
<td>Wildlife health</td>
</tr>
</tbody>
</table>
lutants, into the ocean. This law resulted in an increased aerial monitoring of oil spills and improved possible prosecutions.

2) Restraining of Oil and Environment Restoration
A variety of heavy equipment is directed to the spill including pumps, storage barges, booms, skimmers and shoreline cleaning gear. After a spill, the party responsible must contract an organisation (usually ECRC) to control the spill. The teams mobilise a tremendous amount of logistics (boats, trained personnel, safety equipment, housing, food supply).

3) Assessment of Impact on Birds
In Quebec, the Canadian Wildlife Service maintains a computerised database on the bird population along the St. Lawrence River. It includes species and its conservation status, number of birds related to the location and time of the year. Thus, the potential impact of the spill can be roughly estimated. Nevertheless, a bird inventory is started in the affected area by volunteers, biologists on shore or by aerial surveys. Gulls are used as indicators because oil is easily detected visually on their white plumage.

4) Deterring Wildlife
The impact on birds is not necessarily proportional to the amount of the oil spilled. A small spill can be dramatic if a large flock goes into it. Thus, it is crucial to prevent the birds from coming into the spill. Different deterrent techniques exist in order to keep birds away. Pyrotechnical devices (propane cannon, starter pistols) and horns can be used from the shore or from boats. Helicopters, falconry and even small radio control airplanes can be useful. The Breco Bird Scarer© (Whisson and Takekawa, 1998).

| Table 15.2. International oil spill response organisations or training opportunities. |
|---------------------------------|-------------------------------------------------------------|
| **Name**                        | **Description**                                             |
| International Bird Rescue Research Center (IBRRC) | Private non-profit organisation, USA http://www.ibrrc.org/ |
| Oiled Wildlife Care Network (OWCN) | University of California Davis, School of Veterinary Medicine, USA http://www.vetmed.ucdavis.edu/owcn/ |
| Tri-State Bird Rescue and Research | Private non-profit organisation, USA http://www.tristatebird.org/response |
| Focus Wildlife                  | Private non-profit organisation, Canada and USA http://www.focuswildlife.net/ |
| Office of Spill Prevention and Response (OSPR) | http://www.dfg.ca.gov/ospr/ |
| International Petroleum Industry Environmental Conservation Association (IPIECA) | http://www.ipieca.org/ |
| Centre of Documentation, Research and Experimentation on Accidental Water Pollution | Oil spill response in France http://www.cedre.fr/index_gb.html |
| International Alliance of Oiled Wildlife Responders (IAOWR) | Group of oiled wildlife responders meeting periodically to promote best practices and to promote networking in the domain. |
| Effects of Oil on Wildlife (EOW) | International meeting occurring every two years to improve communication of best practice in oiled wildlife response. Tallinn, Estonia October 2009 : http://www.eowconference09.org/ |
was created in Quebec in the mid-1990s. It follows the oil spill as it is displaced by the tide, wind and waves. This equipment can be efficient if used in a very short time after the spill. The best approach would be to have them ready to launch from the ship involved in the spill.

5) Initiation of Wildlife Rescue

Undertaking a bird rehabilitation operation is not yet a legally regulated decision in Canada. Governmental, media and public pressures usually influence the party responsible to financially support the operation. The challenge lies more in the logistics than in the basic principles of cleaning a contaminated bird. Best practices are described by US Fish and Wildlife Service (2003, 2005) and by Beaulieu and Fitzgerald (1996). Other documents are in the process of being completed by IBRRC. The rehabilitation centre (permanent or temporary) must meet these basic requirements to be efficient:

• water softeners must be installed if the hardness of local tap water is > 3 grains (50 mg/litre);
• nearly 3,000 litres of hot water (40-41°C) per hour may be necessary, thus high-performance water heaters are essential;
• water pressure for rinsing with a hose must be near 40-60 psi;
• large supply of liquid soap: Dawn® is preferred at concentration of 1-4%;
• ambient temperature must stay around 25-30°C and ventilation should recycle 8-10 volumes per hour.

The preparation of the facilities can be started while the capture operation takes place. It often takes a few days after the spill to capture the first birds. Throughout the whole rehabilitation process, veterinary supervision should be provided. Post-mortem of dead birds should be carried out, as well as some clinical laboratory tests on live birds to detect infectious diseases. Diving birds are generally sensitive to aspergillosis and preventive antifungal treatment, e.g. itraconazole at 10 mg/kg once a day orally (Sporanox®, Janssen-Ortho, Toronto, Canada), is recommended. Rehabilitators should be aware of contagious diseases such as avian cholera, avian influenza and duck herpes virus. The stress induced by rehabilitation and confinement could aggravate the spread of these diseases. Nobody would like to introduce a contagious disease into the wild population with the release of infected birds that are only temporarily without symptoms. With the new concerns about avian influenza, it is also recommended that no volunteer should be allowed to work with the birds while having symptoms of human influenza. Security and safety should always be part of the planning and the training on the premises. We do not want animals to get hurt, nor people.

6) Capture

Oiled birds can be captured using nets from boats or on the shore. In some cases nocturnal captures with intense lighting can be performed but staff safety should not be compromised. Other situations may necessitate the use of traps. In any cases, the skills of the capture team will have an impact on rehabilitation efficiency. The capture must be carried out as soon as possible because the health of oiled birds is compromised by the lost of thermoregulation, their energetic status (oiled birds stop feeding and consistently preen their feathers) and the ingestion of toxic products.

7) First Aid and Triage

On admission to the rehabilitation centre, birds have to be examined. Birds not only need to be cleaned but also need to be treated for hypothermia (hyperthermia if birds are confined in small boxes in a truck on a hot sunny day), for body condition (thin or emaciated) and for chemical irritation or intoxication. Life support must be administered including warm fluids, digestive tract protectors, warmth and food. Euthanasia may have to be performed on severely debilitated birds. Only when the bird’s health status is considered sufficient to cope with the procedure may it go to the cleaning section.

8) Cleaning

It generally takes 2-3 persons to hold the bird and to perform the cleaning in successive water baths. After 3-4 soap baths, it may take 4-5 clean hot water baths to rinse the soap off the birds. Feathers are then rinsed with an appropriate hose (40-60 psi water pressure). There should not be any oil, detergent or calcium carbonate residues remaining on the feathers (Bakken et al., 2006). The formation of water droplets on the feathers is an indicator that
the feathers are recovering their water repellency. Finally, the bird should go into a drying enclosure. Commercial pet air dryers are usually connected to small pens to achieve this step.

A bird washing machine has been developed (http://www.fost.fr/mlo_en.html) to facilitate cleaning operations but its efficiency is not recognised by all rehabilitators. This machine necessitates fewer people to perform the cleaning but the stress experienced by the bird is not decreased and cleaning results are inferior to those achieved by manual washing. Again, the issue of the whole process is not to clean birds but to rehabilitate them. Most of the energy must be devoted to the stabilisation first, and then reconditioning after the cleaning.

9) Reconditioning
All steps are important but this step is crucial. After the cleaning steps, the bird must recover its full water repellency. Indeed, the feathers are water repellent because of their structure. The massage effect of the water pressure during the rinsing step and feather preening are essential to the recovery of the normal feather structure. The bird needs to be able to move and eat in a pool (diving, floating, swimming). The salt gland of a pelagic bird must be efficient to allow the bird to drink salt water without getting intoxicated. The supraorbital glands (also known as salt gland or nasal gland, located ventrally to both eyes) concentrate and excrete salt. These glands secrete a solution up to 5% NaCl. When a pelagic bird is kept in fresh water for a while, the gland becomes atrophied and needs to be reconditioned before regaining its normal function.

Efficient pools are required. A water overflow system helps keep the water clean but necessitates a significant flow rate. Dirty water contaminated with bird faeces and fish oil may make a second cleaning necessary because it is detrimental to restoring feather waterproofing.

10) Release
Before considering the release of a rehabilitated bird, some health criteria must be looked at: body condition, weight, haematocrit and other blood chemistry parameters (Anderson et al., 2000). A location appropriate for releasing rehabilitated birds should be selected; it is important to avoid the contaminated area or areas where the food chain has been severely affected. If the breeding site is involved, the birds may try to come back to the spill site before the habitat is cleaned and become re-contaminated. Bear in mind that if rehabilitated animals are game birds, they could subsequently be ingested by (human) hunters.

11) Post-release Survival Assessment
Oiled wildlife rehabilitation still has to make progress, even if tremendous improvements have been achieved over the last 20 years. The survival and reproductive success of the rehabilitated birds are the parameters measured to evaluate the success of the rehabilitation. Banding (ringing), transmitters (implantation or harness) and subsequent tracking, along with breeding success surveys, can all help documenting these parameters.

Bird Population at Risk and Priority Species List

In general, people would rather not discriminate between species and do whatever can be done to save every single bird affected by the spill. However, it is well accepted that the number of birds that must be treated may overwhelm the capabilities of the facilities. It is possible that difficult decisions have to be made: selecting the birds with the best chances of surviving the whole process or choosing the species with a particular status (endangered as opposed to abundant species).

The Canadian Wildlife Service has developed a cleaning priority index of species in the event of a spill (Daigle et al., 2006). The concept of a population management approach is not largely accepted in the oiled wildlife responder community, but the Canadian Wildlife Service index takes into consideration the population, its productivity, its conservation status, and its relations with economic activities. For instance, over recent years the snow goose (Chen caerulescens) population has expanded so much in Canada that spring hunting has been launched. In 2000, an inland oil spill affected a group of around fifty snow geese near Victoriaville in Quebec. The decision was taken to capture and to humanly perform euthanasia on this group instead of setting up a rehabilitation operation.
By contrast, the St. Lawrence River harbours some vulnerable species such as harlequin duck (*Histrionicus histrionicus*) and Barrow’s goldeneye (*Bucephala islandica*). With a wild population of 2-4 thousands individuals living on North America’s East Coast, a major oil spill occurring in an area densely occupied by one of these, during wintering for instance, could be dramatic. The authorities would then probably do everything they possibly could to save as many individuals as possible.

**Environmental Cost and Benefits of the Response**

Some studies have shown that aggressive habitat restoration (cleaning shores with high pressure and washing devices using high water pressure) can affect or be more detrimental to the micro-environment than if the impacted area were left alone (see Whitfield, 2003 and Arnold, 2011). Research has been conducted to develop micro-organisms that could be dispersed in the spill and degrade petroleum products.

Regarding wildlife rehabilitation, the amount of money, human resources and tap water needed to manage a crisis professionally is tremendous. The use of fresh water is becoming a worldwide sensitive issue. It may become impossible to operate with success in certain remote areas. For instance, on the Iles-de-la-Madeleine located off the Quebec Atlantic coast, water availability would not support a bird rehabilitation centre during an oil spill. There is no technology available yet that allows sea water to be used to clean oiled birds. Such a technology would probably be prohibitive energy- and cost-wise. In some countries burning the oil spill and killing (gun shooting) affected birds have been considered the best option.

Furthermore, it has been reported by some scientists that rehabilitated oiled wildlife may not survive after the operation or that the reproduction rate is compromised, rendering the whole process useless (Anderson et al., 1996). However other field studies (using transmitters) on the survival of those animals and evaluating breeding success have justified rehabilitation efforts (Underhill et al., 1999). There is no doubt that where an oil spill affects an endangered species, at least an attempt to rehabilitate is recommended. In these instances, the skills and expertise acquired through the years with more common species will be significantly beneficial.

**Conclusions**

Prevention is the key to protecting wildlife from oil spills. It is generally accepted that most infamous oil spills, such as that from the Exxon Valdez, could have been avoided. Regulations (local as well as international) promoting safe tankers and ways to manage the oil industry will never be too strict to protect both environment and wildlife. Improvements in prevention have been carried out by more stringent regulations regarding boat safety and training requirements for pilots. Statistical trends show a decrease in major spills in recent decades. (see : http://www.itopf.com). However, as long as dangerous products are widely transported, we will never be totally safe from environmental disasters. To be ready to cope with those, preplanning and networking are essential. The response needs to be performed professionally or not at all!
References


Further Reading:


Chapter 15


Chapter 16

Further Reading:


References


Whitfield, J. How to clean a beach. http://www.nature.com/nature/journal/v422/n6931/full/422464a.html