HANDBOOK ON OIL IMPACT ASSESSMENT

4.0 SPILL RESPONSE

4.1 Assessing the damage

Introduction

The four basic questions to be answered by an impact assessment are (i) what has been killed, (ii) how many, (iii) where did they come from, (iv) can any effect be detected at the population level? Demonstrating any effect on seabird populations of even a major oil spill has not been easy, and few case studies have been able to do so convincingly. Firstly, the different species affected must be identified and the mortality quantified. This normally involves searches of the polluted coastline for oiled victims (beached bird surveys), and these surveys are most effective if they are planned and directed, in co-operation with the teams responsible for cleaning up the oil. Not all birds that become oiled will be found on even the most thorough beached bird surveys, and this proportion will vary depending on factors such as the distance from shore of the point source of the spill, the nature of the coastline, the type and volume of oil, and prevailing winds. A drift experiment, where real or simulated seabird carcasses are marked and dropped in the vicinity of slicks, to be later recovered on beached bird surveys, can help estimate the proportion of the total mortality that was actually found. This is best planned for in advance, and conducted during the early stages of an incident.

Figure 4.1.1 Stranded, slightly oiled Common Guillemot *Uria aalge* © CJ Camphuysen

For many seabird species the only data on population sizes and trends comes from counts at the breeding colonies, but most seabirds are migratory, or at least spend much of the year well away from their breeding sites, whereas most oil spills occur during winter months. A small proportion of seabirds have been ringed (banded) at their

colonies, which may indicate breeding origins, but for most species this percentage is either extremely small or heavily biased towards particular well-studied locations. Fortunately, widespread seabird species normally vary in size over their breeding range and careful measurements (biometrics) can help indicate likely breeding origins, and where best to look for population impacts. Seabirds also have a period of immaturity lasting several years before attaining breeding age, with the different age classes having different natural survival rates, and often different winter distributions. It is therefore important to established the age structure of the mortality for each species, since their populations are most likely to be impacted if the victims are mostly breeding adults (with normally high winter survival), rather than birds in their first winter, many of which would have died naturally before the following summer. Finally, it is important to establish the sex ratio of the mortality since male and female seabirds can have different wintering distributions, and an incident could kill adult birds of either sex disproportionately.

These key elements of a wildlife response for impact assessment are generic to any incident: organised beached bird surveys, a drift experiment where feasible, and the recording and examination of the dead birds collected. This needs close co-operation with those involved in the rehabilitation response for live birds, and with the authorities in charge of the overall response. Being prepared should also involve collating data on the numbers and distribution of the wildlife resources at risk in your area. This will not only help guide the overall response, but may itself be part of the impact assessment for species such as arctic waterfowl whose breeding origins, numbers and densities are poorly known, and for which counts in winters following the spill may be the best means of detecting any population effect. This manual provides guidance for wildlife responders during an oil spill, and introduces standard protocols and methodology that aid the impact assessment and help provide comparisons between different incidents.

4.1.1 Tasks

If your local, regional or national oil spill contingency plan includes provision for dealing with wildlife casualties, then it should include options for a location from where to organise the wildlife response, and identify the organisations that will provide the management roles that will need to be filled. If not, these are the first tasks to be done. The response centre should be a multi-roomed facility, ideally existing offices, or rooms capable of being adapted quickly to provide normal office facilities such as working desks, power points for computers, photocopier, fax etc., communications, a dedicated meeting room, and basic catering and toilet facilities. Management roles that need to be considered will include (i) planning and directing beached bird surveys and any carcass experiments, (ii) management of volunteers and their needs (equipment, health and safety, transport, food, accommodation), (iii) organisation and/or supervision of post-mortem examinations, (iv) record-keeping and database management, (v) finance and liason with insurance/compensation authorities, (vi) liason with the incident management team. Other tasks such as ensuring safe and legal waste disposal, liason with the scientific community and conservation organisations, and media relations need to be considered, but no two incidents are the same and the number of people required to fulfil these tasks will depend on local circumstances.

The main task during a spill is to establish a reliable count of the casualties, both dead and live, to identify them to species, examine them for characteristics or markers that might indicate their breeding origins, and to age and sex them as far as possible. These procedures should be generic to any major oil spill, they are part of the spill response and are essential to understanding the impact on seabird populations, and should not be considered as academic research. Counting carcasses is not too difficult, but collecting them and keeping an accurate record throughout an incident that might involve many thousands of birds and extend along hundreds of kilometres of coast requires organisation and attention to detail. Beached bird surveys should be planned and directed, and early and serious consideration should be given to estimating the proportion of carcasses not found, either by drift experiments at sea, or by calculating disappearance rates from experimental beaches. The specific identification of dead seabirds, especially those that are very heavily oiled or are incomplete, is less easy than many people who have not participated in beached bird surveys realise, while taking biometrics and conducting internal examinations for age and sex will require expertise that may not be readily at hand.

Beached bird surveys Systematic beached bird surveys are best carried out by dedicated volunteers, supported by a core of people experienced in oil spill response {beached bird survey manual}. They should be planned and directed, based on the latest information on the extent of oil, projected slick trajectories, and known concentrations of vulnerable seabirds. Routine beached bird survey schemes already exist in many countries {European contact

addresses} and where possible, experienced volunteers from these should be used. An efficient collection and transportation system will need to be organized for both live and dead birds, and beach clean-up teams should also be instructed to collect any oiled birds they encounter, separate them from waste material, and have them labeled and collected at regular intervals. The basic information that should accompany both live and dead birds is the date and location of finding. Members of the public not involved in directed surveys will inevitably encounter oiled birds during casual visits to the coast and should be informed via the local media as to where to bring birds found. Survey teams should be asked to report sightings of live, oiled birds that could not be caught (flocks of oiled waders and gulls tend to be under-reported during large spills). Surveys should cover the geographical extent of the affected coastline and find its limits, as well a concentrating on core areas, and should continue for the duration of the incident. Health and safety issues will vary greatly, depending on the nature of the coastline, season, and prevailing climate, but the health and safety of volunteers should be the paramount concern. Advice should be sought from the responding authorities on the nature and toxicity of the oil, and the degree of personal protective equipment required. Consideration should be given to issuing volunteers with some form of identification (e.g. a printed reflective waistcoat) which can tell the authorities that they are part of the formal spill response.

Figure 4.1.2. In many European countries, beached bird surveys have been organised since the late 1960s to monitor seabird strandings resulting from chronic oil pollution. It is strongly recommended to respect existing schemes during oil incidents and to recruit experts from these organisations to set-up or assist with high quality beached bird surveys during spills. © G Jonker (left), CJ Camphuysen (centre), JE den Ouden (right)

Species identifications and further examinations Best practice is to collect all oiled birds at a central location for recording, any further examination, and eventual safe disposal. It should be remembered that oiled seabirds left on or near the shoreline present a toxic threat to scavenging wildlife. Scientific oversight should be established rapidly, to decide the level of examination that is practicable given the resources available, to identify and source relevant expertise, and to determine the fate of the biological material collected. To plan this work properly, it is important to know which species are likely to be involved and how heavily they may be oiled. Accurate identification and ageing and sexing by external characters is generally impossible under field conditions if birds are fully covered in oil, so casualties should be processed in a (simple) laboratory facility.

Figure 4.1.3. Improvised, but adequate laboratory facilities at A Coruña University during the Prestige oil spill (left) and in a geology department warehouse during a mystery spill in Estonia (right). © Hugo Nijkamp (left) and Leho Luigujõe (right).

In situations where species, age and sex is clear (e.g. strandings of partly oiled waterfowl), examinations can be done quickly by experts and the carcasses disposed of immediately. Consult the species/bird families technical documents for ageing/identification issues. However, in most cases, conducting a proper impact assessment means examining birds in laboratory conditions. If this is not done, it is important to check all carcasses thoroughly for leg rings or other markers before disposal, and it should be remembered that scientists increasingly attach (expensive) remote-sensing devices to seabirds for research.

Laboratory work Depending on relevant national legislation, authority should be given quickly to the scientific team allowing them to examine corpses, and to have the option of transferring them to other institutions if necessary. One of the key management and scientific decisions to be taken early in an incident is whether to conduct post-mortems concurrently with the field response, or whether to simply confirm and record species, numbers, dates and locations found, and then store carcasses frozen for later examination. Concurrent examination has the advantage of being able to provide more or less instant advice to rehabilitators, scientists and conservationists on the nature of the mortality. Storage of the carcasses may seem more convenient at the time, but can cause some logistic problems, not least with eventually arranging a mass post-mortem, and has the potential for loss of data on date and location of finding. In either situation, scientific advice can determine which species to prioritise.

Figure 4.1.4. Basic, but adequate laboratory facilities at Royal Netherlands Institute for Sea Research, Texel, The Netherlands, with severely oiled Common Guillemots and Razorbills lined up for dissection.

Note that in order to protect the furniture, plastic foil is needed. The oil on carcasses such as these will melt at room temperatures and leak away.

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Laboratory facilities needed for standard autopsies may be integrated with those for the rehabilitation of oiled birds, but it should be remembered that these aspects of the response have very different requirements in terms of personnel, infrastructure, hygiene, and security. Facilities can be fairly simple, the key requirements being easy access (sacks of oiled birds are very heavy!), workbenches at standing height, good lighting, hot and cold running water (preferably with an interceptor for oily waste), and (preferably) some ventilation (Figs. 1-2). Cover entrances, walkways and work surfaces with plastic sheeting to avoid unnecessary oil contamination. Deep freezers should be available, the size and number depending on the scale of the incident and the potential scientific value of the biological material. Carcasses should be processed on a daily basis, for as long as the responders can keep up with the numbers found. If numbers exceed capabilities, sub-sampling is one option, but try to spread the sampling geographically and temporally, because during prolonged incidents the species and age structure of the mortality is likely to vary with time, especially at migration seasons. Any frozen carcasses received will need c.24 hours at room temperature to thaw before processing. Ensure a system is in place to receive carcasses of birds that have died at rehabilitation centres, even if they have been autopsied for veterinary purposes, so they can be incorporated into the database. Facilities should be available seven days per week, with at least one person dedicated to supervision of the autopsies, another to logistical tasks such as maintaining equipment and the flow of birds (including their safe and legal disposal), and a third maintaining a database and being responsible for disseminating information. Preliminary analyses of results should be reported regularly during the spill (ideally daily on a dedicated web-site), so that an overview of the potential impact on seabird populations can be accessed by all involved or otherwise interested the event: government agencies, NGO's, journalists, scientists, seabird rescue workers, clean-up teams and others. Such a website could also advertise what biological material is available for purposes such as museum curation or DNA and isotope analyses.

The basic steps involved in post-mortem examination are recording date and place of finding, identification to species, checking for rings and other markers such as satellite transmitters (not always easy in the case of heavily oiled birds), detailing the oiling status of each bird (% oiled), external ageing and sexing where possible, external biometrics to help determine the age and breeding population of origin, and internal examination to determine sex and age. In most situations, up to 100-150 birds can be processed per day in a well-organised facility. In the event of more birds being found, some procedures may have to be curtailed or arrangements may have to be made for freezer storage once the initial logging, specific identification and checking for rings has been completed.

Drift experiments Ideally, total estimates of mortality derived from counts of dead birds that wash ashore should be corrected for the numbers lost at sea. If an oil spill occurs far from land or in offshore winds, seabird mortality can be greatly underestimated even with the most thorough beach bird surveys (Threlfall & Piatt 1983, Keijl & Camphuysen 1992, Hlady & Burger 1993). Corpses floating at or near the surface are subject to drift caused by the prevailing wind (Hughes 1954; Matsumura *et al.* 1990), and periods of onshore winds obviously lead to more strandings than prolonged periods of offshore winds. There is a long history of drift experiments around the world, in which marked bird corpses or drift blocks designed to mimic oiled seabirds have been used to calculate a common correction factor for bird strandings (Bibby & Lloyd 1977, Bibby 1981, Stowe, 1982, Keijl & Camphuysen 1992, Hlady & Burger 1993).

Figure 4.1.5. Drift experiment using individually marked carcasses of grebes Podicipedidae and seaduck *Mergus* spp, *Bucephala clangula* drowned in fishing gear of the Dutch coast, February 1991 (© G.O. Keijl).

The results of these experiments have been rather variable and have tended to be location-specific, with coastal features, weather conditions, and the types of tags used leading to different results (Camphuysen & Heubeck 2001, Wiese & Jones 2001). Wind seems to be the predominant factor determining movement over large distances (Hughes 1954), whereas tidal currents can influence deposition on specific beaches (Wiese & Jones 2001). Instead of using an average derived from these previous results, the best option in the event of an oil incident is to set up and perform a drift experiment in the early stages of the spill to evaluate local conditions (cf. Colombé *et al.* 1996, Arcos *et al.* 2004).

4.1.2 Health and safety

The health and safety of all participants in any oil spill response, whether professionals or volunteers, should be of paramount concern. Safety issues will vary according to latitude, season, and the nature and remoteness of the affected coastline but some aspects should be generic. If volunteers are being asked to search oiled coastline it should be very clear at the outset whose authority they are operating under, and who has legal liability in the event of an accident or subsequent illness connected to their activities. The lead organisation should have a risk assessment in place beforehand, take prompt advice from the responding authorities on the nature of the oil involved and any particular hazards it poses to health, and arrange safety briefings for volunteers. Participants should be asked about any chronic health problems such as skin or respiratory complaints, which may be exacerbated by exposure to oil and its vapours. For directed beached bird surveys, a log (with contact details) should be maintained of where and when teams are operating, teams should report in at the end of each day, and strict protocols should be in place if boat work is anticipated. Lone working in the field should be discouraged and teams should be aware of weather forecasts and tidal states. Personal protective equipment should be issued to both minimise contact with oil and cope with weather conditions. Oil exposure during field and laboratory work can result in several levels of toxicity (Laffón *et al.* 2006; Pérez-Cadahía *et al.* 2007). Appropriate protective clothing and masks have to be available for all the personnel involved in the different tasks of the impact assessment, and volunteers should be instructed in their use and risks of not using it. Incidents involving shipwrecks can result in hazardous cargo or other objects washing ashore, and a system should be in place for reporting these to the authorities. These and other potential problems and solutions are all best thought out beforehand and dealt with in an oil spill response plan, rather than being hastily considered in an emergency, or worse, after an avoidable accident.

4.1.3 Costs

There will be costs involved, which should be met by those responsible for the pollution. These costs include (1) staff time and expenditure for the organisation co-ordinating the response, (2) travel, accommodation and subsistence for any expertise requested to assist, (3) accommodation, subsistence, vehicle hire and fuel for beach teams, (4) any costs involved in arranging laboratory or similar facilities and the disposal of dead oiled birds, (5) basics such as protective clothing, disposable laboratory equipment, and cleaning materials, and (6) analysis of the data and publication of the results. The organising body should work in close conjunction with the local/national government and the relevant insurers in agreeing and tracking this expenditure, providing interim payments where necessary, and eventually processing a claim to the International Oil Pollution Compensation Fund (or whichever body is responsible for compensation). However, it is essential that immediate contact is made between those planning to spend money on assessing the impact of a major spill on seabird populations, and those on the scene who are both advising on, and responsible for refunding costs.

4.1.4 Pre-planning

Pre-planning is essential for an effective response, and all countries or regions vulnerable to oil spill events (and some spills may impact more than one country) should identify which organisation is prepared to take the lead role in co-ordinating the systematic beach search effort, identifying facilities where dead birds can be examined, and sourcing the expertise to conduct post-mortems. A questionnaire distributed during the production of this manual

has resulted in the identification of individuals in numerous European countries, as a first step in pre-planning oiled wildlife response.

A rapid response should not be constrained by the fear of expenditure, which might be considerable in terms of the assets of that organisation, but will be minimal in terms of the overall costs of response and cleanup. It is worth noting that many of our recommendations above were largely endorsed by the published reports on the environmental impacts of the 1993 *Braer* oil spill in Shetland, Scotland (Ritchie & O'Sullivan 1994) and the 1996 *Sea Empress* oil spill in south-west Wales (SEEEC 1998). Governments, conservation organisations and seabird biologists need to learn the lessons of the past, and not re-invent the wheel each time they are forced to cope with a major oil spill.

Technical documents

Associated technical documents with the impact assessment part of an oil spill response are arranged in four separate lists:

BBS manuals	• Setting up beached bird surveys • Drift experiments	Suggestions on how to design and set up beached bird surveys and drift experiments in case of an oil spill, with reference to earlier studies and existing monitoring schemes
Lab manuals	• External examinations • Standard autopsy manual • Ageing and sexing manual • Condition manual • Diet study manual • Disposal of contaminated birds	Practical manuals describing standard techniques for collecting biometrical data of stranded seabirds (with reference to bird family descriptions that provide more species-specific information), to perform a standard autopsy, on assessing age and sex following internal characteristics, on assessing physical condition and organ health of the casualties, and finally suggestions for practical diet studies.
Bird families	• European seabirds (list) • Gaviidae • Podicipedidae • Procellariidae • Hydrobatidae • Sulidae • Phalacrocoracidae • Phaethontidae • Anatidae • Phalaropodinae • Stercorariidae • Laridae • Sternidae • Alcidae	Species specific information, arranged per family, focusing on general distribution patterns, geographical variation, biometrics, and identification guidelines (including sex and age from external characteristics). **Note:** The citations of the literature used in these technical documents will not and cannot replace the original sources! The technical documents are meant for quick reference only, they will be constantly updated and advice to improve these texts and tables will be greatly appreciated!
Shopping lists	• BBS materials • Drift experiment materials • External examination materials • Standard autopsy materials • Diet study materials	Lists with illustrated examples of basic materials needed for any of the work described earlier

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