Oil Spills and Marine Wildlife:

Guidelines for a Response Plan for the Isle of Mull

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Project commissioned by
the Hebridean Whale and Dolphin Trust

29 September 1999

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Acknowledgements

Thanks must go especially to Alexander Taylor, Liz McTeague, Mark Steward, Chris Parsons, Richard Evans, Paul Yoxon, UCDavis, Dr R.Clark, Mike Burrows and Steve Monks for talking to me and sending me information. Thanks must also go to those people who helped me with useful advice that if I'd had more time I would have liked to have included in the project: Nick Clamp from MCA, Craig White and Charlie Self from the RSPB and many others whose names escape me.

I would also like to thank Jon Side for his advice, Neil for helping me originally with the maps and all the students for making me endless cups of tea.

This report should be cited as:

Hill, J.A. 1999. *Oil Spills and Marine Wildlife: Guidelines for a Response Plan for the Isle of Mull.* The Hebridean Whale and Dolphin Trust, Mull. 119pp.

Abstract

The Inner Hebrides is renowned for its diversity and abundance of marine wildlife. Unfortunately this means that it is extremely vulnerable to the threat of a wildlife emergency such as an oil spill. Action therefore needs to be taken to protect this wildlife and in order to do this a response plan should be drawn up. Before this can be fulfilled a set of guidelines detailing important points that should feature in the response plan should be written. These guidelines outline primary considerations such as the species of seabird, otter, seal and cetaceans found in the area, the effects that oil will have on them and their vulnerability and how to establish the priorities for protection. Current rescue and rehabilitation techniques for these species have been outlined and recommendations made based on past mistakes from previous wildlife rescue efforts. Most importantly local facilities, personnel, equipment and other logistics for effective response decisions have been identified as vital for a rescue effort and an attempt has been made to fill in some of this information.

Introduction

When oil spills occur, it is highly probable that the oil will contaminate areas inhabited by wildlife and have devastating effects on a variety of species. Action therefore needs to be taken to protect wildlife resources. The only real way to save wildlife and their habitats is to prevent oil spills, but no matter how much effort is put into prevention, with the increase in shipping traffic, an oil spill is an inevitable consequence. Great emphasis should ideally be given to cleaning up oil before it reaches the coast, but even then the risk still exists that it will wash up on shore. The best thing then is to plan ahead to minimise the damage.

Do we need a plan?

Many studies have looked at the impacts of oil spills. A report by SEEEC (1998) showed that large numbers of marine organisms such as limpets and barnacles were killed and populations of amphipods wiped out of certain areas. Birds have also been shown to be at risk. Those birds that spent the majority of their time on the sea surface such as the common scoter, guillemots, razorbills and divers were particularly vulnerable to oil spills.

Although the oil from the *Sea Empress* killed large numbers of marine mammals and several thousand birds, SEEEC (1998) concluded that the spill had remarkably little long term impact on the coastal environment and resources of South -West Wales and the conclusion to these studies was that:

1. There appeared to be no impacts on mammals. Fish and mammals appeared to be able to avoid the worst of the oil.
2. Although tissue concentrations of oil components increased temporarily in some fish species, very few were affected.
3. Several important populations of seabirds were not significantly affected and there was no evidence of any effects on seabird breeding success.
4. Rare plants in the area were not significantly affected.

But if all these conclusions are true does this mean that we shouldn't worry about these species saying that studies show there is no obvious effects of oil spills. There were actually very few fish in the area as they were still out to sea for the winter and hence

the feeding activity of the seabirds was at a seasonal low. Several important bird populations such as Manx shearwaters and puffins had not yet returned to their breeding grounds in the region and it wasn't the seal pupping season.

The *Braer* spill was also reported to lack serious impact. It may have contributed to the deaths of two seals and maybe a few otters. A large number of seabirds were found to be oiled after the spill but the number killed represented only a small percentage of the population and the effect on breeding seabirds was confined to guillemots (Davies & Topping 1997). However we cannot predict that there will definitely not be any significant impact on wildlife. Attempts were made to clean and rehabilitate nearly 8000 oiled birds (mainly auks) following the wreck of the *Torrey Canyon* disaster, which was estimated to have caused the deaths of at least 30,000 birds (Clark 1978). This was also almost a total failure due to inexperience in cleaning and handling of such a large number of oiled seabirds, only 6% of the cleaned birds survived for at least a month (Freedman 1995) and none of the birds were restored to the natural population.

Despite immense expenditures, The *Exxon Valdez* spill in 1989 is known to have caused widespread mortality of over 1000 otters, (although this number is believed to be more), over 250,000 seabirds, 250 bald eagles, 300 seals and the loss of 14 whales from one pod. This represents the largest known mortality due to oil (St. Aubin & Geraci 1994). The capture and rehabilitation costs are believed to have amounted to $45 million, 18.3 million dollars of this for sea otters alone. Reports have also indicated that approximately only 222 otters were saved, giving a total of $80 000 per animal (Estes 1992).

Effects on populations is due to a number of factors such as the time of year, type of oil, weather conditions and clean up response. Population sizes of many species fluctuate from year to year and the fact that a particular oil spill hasn't had a seriously damaging effect on the population does not mean that there won't be one next time so it is best to be prepared for any eventuality.

Therefore a strategy is needed for wildlife response. Most importantly, experienced personnel and sensitive areas need to be identified to protect the most vulnerable species. If protection fails then one of the options is to try and rehabilitate the contaminated animals. However indications are that many released animals are not successfully rehabilitated back into the wild. The responsible parties often spend vast

sums of money trying to undo or prevent further damage to both the environment and their reputation, but is this totally justified. A research unit on the rehabilitation of oiled seabirds was established in Newcastle upon Tyne to devise effective treatment methods. These methods have been used successfully but even with appropriate organisation and facilities it is doubtful whether the rescue and rehabilitation of oiled birds can make a material contribution to seabird conservation, but there is often strong public pressure for the treatment of oiled birds.

This is because when a spill happens, it elicits feelings of shock and anger and the feeling that 'something must be done', but improperly conducted rescue efforts are unsuccessful and costly. There is no point in channelling resources and expense into a clean-up exercise just to be seen to be 'doing something'. It does seem that cleaning oiled wildlife could be just a PR exercise for the public and oil companies, when most of the time putting the animals out of their suffering would be more humane. This is however a hard thing to accept and is unlikely to be accepted. But the facts remain. The sight of oiled birds raises strong feelings of concern amongst the public and the media and oil companies want to redeem themselves. After the *Exxon Valdez* disaster in 1989, eight centres were established; three for otters, four for birds, and one for raptors (Loughlin 1994). Over 140 boats and five aircraft were dedicated to the rescue operation. This bird and sea otter rehabilitation program was the largest and most comprehensive effort of its kind ever attempted, yet it was not found to be hugely successful. These findings cast doubt on our ability to rescue and rehabilitate oiled wildlife and also highlights its expense and ineffectiveness.

So why should we respond?

Without attempting to rescue and rehabilitate wildlife do they have a chance of survival? We should evaluate the need for and the effectiveness of the response and take into account any regulatory or jurisdictional responsibility for key species that may be at risk in an oil spill.

If the species or population is threatened with extinction or decimation then surely this should play a deciding factor in clean up responses. The availability of clean up methods, equipment and trained personnel will also play a part. Is the time and expense spent rehabilitating wildlife justified to save a few individuals that according to a report by Clark *et al* (1997) only have a 1% chance of survival post-release anyway?

This question cannot be answered. Pressure from the public and environmental groups would be too high to allow governments and oil companies to sit back. Taking an example from the *Braer* spill, right from the start the Wildlife Response Co-ordinating Committee had decided that every effort would be made to try and save the lives of any oiled birds and mammals. Justification for this was based on humanitarian grounds even though it was recognised that the numbers of individuals saved would probably involve too few to offset the impact on the populations of the species affected and that logistically it would be more complicated than just humanely destroying them on site. Conflicts will also always arise between different conservation interests e.g. the need to remove oil in order to protect bird species and the need to preserve the integrity of a shoreline such as saltmarshes. The best practical environment option for saltmarshes is not to carry out any clean up as the clean up activities themselves may be more damaging than the presence of the oil. The same cannot be said for rescuing birds. A response plan for oiled marine wildlife should be drawn up.

Does this area need a response plan?

The Inner Hebrides consists of a group of small and remote islands characterised by a wide range of habitats, so many of which are protected under international and national status. This is reflected in the presence of Special Sites of Scientific Interest (SSSI's), Special protected areas (SPA's), Special areas of conservation(SAC) and National Scenic Areas. In fact, the Inner Hebrides represents over 71% of Scotland's national Scenic Areas so due to time constraints findings have been concentrated on the Isle of Mull and its associated small islands. The coastal nearshore areas around the islands have been recognised as being some of the most diverse marine areas in Europe (JNCC 1997). Its long, rugged, and exposed coastline is sparsely populated and inaccessible and is therefore less vulnerable to anthropogenic pressures than the coast in many other regions. However it also means that the region is particularly vulnerable should an oil spill occur, as its inaccessibility would cause vast problems for mounting a wildlife response. The presence of numerous marine mammals and recognised European and nationally important seabird colonies testify to the importance of this area to wildlife and it also contains important commercial fishing grounds. Mike Burrows from the Dunstaffnage Marine Laboratory (pers. comm.) is one of a group drawing up a list of marine priority habitats and species for the biodiversity action plan. On this list (see

chapter 2), the marine priority species mentioned as being important for protection are all baleen whales, all toothed whales, all dolphins, harbour porpoise and grey and harbour seals, all of which are especially important around the islands of the Hebrides.

The Treshnish Isles contains bird numbers and a seal population of regional importance. Overall, fifteen species of cetacean have been recorded, of which eight (30% of the 27 British species) are present throughout the year or regularly seen on an annual basis. Common seals *Phoca vitulina* are found throughout the region and represent approximately 18% of the GB population, based on numbers of moulting individuals. Breeding occurs on many of the islands and accounts for approximately 9% of the pups born in great Britain. Grey seals *Halichoerus grypus* have many haul-out sites in the west of the region and also breed there. Offshore, the region is important for a wide variety of feeding seabirds, including divers, petrels and shearwaters. Bird fauna of the region cliffs is of national and in some places international importance.

This region is internationally important for several species of seabirds. More than 1% of the European population of 10 species (gannet, storm petrel, shag, lesser and great black-backed and herring gulls, common tern, guillemot, razorbill and black guillemot) breed in the region.

The Treshnish isles are designated as a Special Protected Area (SPA) and are internationally important for the Storm Petrel with over 2000 pairs being counted. Glas Eileanan in the sound of Mull is nationally important for the common tern with 516 pairs being counted. The JNCC seabirds at sea team carried out surveys (JNCC 1997).

Most of the Sites of Special Scientific Interest (SSSI) were selected for their conservation designation partly on the basis of their bryophyte and lichen interest. Many of these sites contain rare and scarce species and qualify for SSSI status on the basis of their lower plant fauna alone, the details of which are too extensive for this project (see appendix 1. for list of SSSI).

Justification of a plan for the Inner Hebrides is therefore reflected in this number and combined extent of sites and species in the area afforded official protection.

How likely is the risk of an oil spill in this area?

Officially none, But is this a question we can really answer? The Inner Hebrides is a low risk area as it is not on a major tanker route and it does not have any oil terminals nearby. However near-miss accidents still happen. On correspondence with the local HMS coastguard he indicated that near grounding on the rocks was a common occurrence as boat owners fall asleep at the wheel. Unofficially, others have reported sighting ships carrying oil in this area, especially during the winter when they take a shortcut through the Sound of Mull. The Sound of Mull is notorious for its rock strewn, current swept waters and a large number of ships have foundered here.

This study therefore deals with preparation and guidelines for dealing with the casualties of an oil spill. It should be mentioned that it is often not feasible to set 'hard and fast' rules for clean up methodology, and decisions will inevitably have to be made on the spot by the on-scene personnel. Ultimate responsibility on shore lies with the local authority who will consult with environmental interest groups and statutory bodies to ensure the most successful clean up operation is mounted. Both coastal and wildlife clean up should be carried out where it is practical to do so and where the clean up activity itself is not likely to be more damaging than the effect of the oil.

Vast areas of the Inner Hebrides are designated conservation sites and this could affect the areas which equipment and personnel are allowed to go. To travel to even a vaguely accessible island in this remote area with unpredictable weather conditions and few local resources could mean that up to 24 hours could elapse between the spill and the arrival of specialist personnel. By the time any emergency response teams get to the islands injured animals will most probably have died and this could affect whole populations of marine animals. Attention has therefore been focused on marine mammals, otters and seabirds but of course it must also be acknowledged that clean up should take into account marine fauna and flora found on the shore. Contamination of fish is also of primary concern because of the important commercial fisheries in this area. An oil spill may cause significant mortality of fish. This is however beyond the scope of this dissertation but consideration should be given to recording the numbers and species found on beaches during a response and volunteers should collect samples if they encounter unusual numbers on shorelines.

AIMS:

This study was proposed as part of two dissertations by the Hebridean Whale and Dolphin Trust. The first dissertation looked at the fate of oil spilt, the direction of the slick and its effect on offshore fish farms. The main concern for this dissertation was the impact that an oil spill would have on the marine mammal populations and the seabirds in the Inner Hebrides. Taking this into account this study has set out to look at the effects of oil and to collate information on the personnel and techniques required to handle various species of oiled marine wildlife and from this information write guidelines for formulating a wildlife response plan. Outlining important personnel and sensitive areas and writing protocols for rescue and cleaning of seabirds, otters, seals and cetaceans will save valuable time in the event of an oil spill.

Guidelines for a wildlife response plan.

General layout.

1. Primary Considerations: Conduct surveys to identify possible spill sites. Identify species in the area, i.e. Seabirds –Petrels, Divers, Cormorants and shags, Gulls, Terns, Auks, Sea ducks. i.e. Otters i.e.Seals i.e. Cetaceans Effects of oil Vulnerability to oil
2. Establishing priorities for protection Locating Sensitive areas Identifying competing demands Availability of local knowledge Variations in priorities
3. **Facilities available for wildlife response** Information on local resources Response centre location Personnel to provide facilities Location of logistics
4. Personnel available roles and responsibilities Outline of strategy for personnel Training of personnel
5. Equipment Identify manpower, equipment resources and location Coastal access points and shoreline types
6. Response decisions Assessing presence of wildlife Factors to consider before collecting and cleaning oiled wildlife Facilities to take oiled wildlife
7. Rescue and rehabilitation **Oiled Birds/ Otters/ Seals/ Cetaceans** Search Collection Selection Initial first aid Transport Intake Cleaning Post-cleaning Release criteria Success of rehabilitation
8. Other Considerations for contingency planning Carcass collection and disposal - identify personnel - potential disposal options Logistics • Logistic support • Funding • Volunteers • Media • Communications • Termination

1. **Primary Considerations:**

There are 3 different levels to a response plan for wildlife.

- **Primary response = PREVENTION OF CONTAMINATION**

The primary response to an oil spill should be to divert the oil away from the shore to prevent the contamination of wildlife. This is done using mechanical methods such as skimmers and booms, or under very specific conditions, using dispersants. Therefore it is necessary to identify species sensitive areas and habitats prior to a spill happening. Dispersants work by removing oil from the sea surface and placing it in the water column where it will degrade naturally.

Advantages to this are that removal of volatile hydrocarbons is accelerated and thus reduces biological toxicity. It also encourages more rapid biodegradation than occurs with untreated oil so oil is less likely to form tarry deposits on the shore and this will benefit any wildlife living there. Dispersants also lead to reduced oil sedimentation, reduced adhesion to organisms in surface waters and reduced toxicity to birds. Thus dispersants benefit some species, such as birds who are found on the sea surface, but not necessarily the fish and other sea life which are underneath the waters surface. These water column organisms will be exposed to a temporary higher local concentration of dispersants and dispersed oil in the water column which will affect survival of the early developmental stages such as eggs and larvae.

- **Secondary response- DETERRENCE**

If logistics show that prevention is impossible then before the oil hits the shoreline, steps should be taken to prevent animals from coming into contact with the oiled area. Protecting those coastal wildlife habitats which have not been coated with oil, should receive the highest priority.

Techniques to manoeuvre healthy wildlife out of the pathway of the spill include herding, dispersal techniques such as audible (e.g. propane cannons, horns), visual(e.g. helium filled balloons, floating and stationary objects)and sensory (e.g. smells) deterrents and pre-emptive captures. Pre-emptive capture i.e. capturing and relocating wildlife to prevent oil contamination requires an immediate response effort. Thus it is generally going to be ineffective. Many deterrent and dispersal techniques have not reliably controlled movements of wildlife and these methods appear to be fairly

unpredictable and may result in the wildlife being manoeuvred into a more dangerous situation than if left. Response plans and research tend to focus on tertiary responses which these guidelines are going to do. There would however be a benefit of doing more research on this secondary type of response.

- **Tertiary response- RESCUE AND CLEAN UP.**

Effort should be directed at cleaning up wildlife habitats coated by oil. Attempts to rescue oiled wildlife are complex, expensive and controversial amongst wildlife groups. There are different opinions on whether attempts should be made to rescue the wildlife when there is such a low post-release success rate or whether affected wildlife should just be humanely destroyed. No two spills are alike so it is important to be adaptable regarding response activities.

Oil spills can happen almost anywhere and at any time and the contingency plan should recognise this by drawing up rescue methods that can be applied anywhere.

These guidelines are focused on principal wildlife species (seabirds, otters, seals and cetaceans) that may be at risk due to an oil spill in coastal waters.

Requirements before developing a contingency plan for tertiary response are to:

1.1 Conduct surveys to identify possible spill sites.

The Inner Hebrides does not appear to be on any major tanker routes, neither does it have any offshore installations although tankers have been known to come through the Sound of Mull during bad weather. Oil spills do not just happen from tankers however. All shipping vessels carry oil in some form and thus a survey needs to be carried out. The coastguard would be the obvious body to know about shipping movements. On contact however, they informed me that this information was not kept on record (Steve Monks pers. comm.) and so this will be mainly speculative.

1.2 Identify species, general characteristics and general distribution in area covered.

It is important to identify the species present in the area and their different susceptibilities to disturbance. Wildlife are more susceptible depending on their breeding season and feeding and foraging habits.

1.2.1 SEABIRDS

Birds are not well surveyed in this area due to remoteness of the islands and vast cliffs leading to difficulty of access for surveyors.

General characteristics

- Abundance

The number of birds found at a colony vary from day to day and counts tend to be estimates rather than an accurate estimate of numbers.

The most abundant sea birds seen in the Inner Hebrides are the Petrels (Fulmars, Storm petrels and Manx shearwaters), Divers, Cormorants and shags, Gulls (herring gulls, kittiwakes, great black-backed and lesser black-backed gulls) Terns (common, arctic), Auks (guillemots, razorbills and puffins), and Seaducks (eiders).

Some of these birds are permanent occupants, some are seasonal visitors and some migratory species which tend to overwinter in coastal waters. All are vulnerable to oil pollution at certain times of the year.

- Reproduction

Most seabirds are long lived and many do not breed until several years old (see table 1). During the pre-breeding phase of their life their annual cycle and pattern of distribution may be very different from those of breeding adults. Those species that lack potential to quickly replace losses, have low breeding success, small clutch size, delayed maturity or high mortality rates among young birds e.g. auks, are highly vulnerable to oil pollution as they only lay 1 egg per year (see table 1) whereas Herring gulls lay 2-6 eggs. It is estimated that 100 pairs will produce 70 young each year, of which maybe only 20% survive to breeding age, therefore the potential rate of recruitment into a breeding population is low. Under normal conditions this rate of

recruitment is balanced out by a high adult survival rate of over 90% per annum (Andrews & Standring 1979).

Table 1. Reproductive success of seabirds.

	Age at first breeding (yr)	**Normal clutch size**
Auks		
guillemots	3-7	1
Razorbill	4-5	1
Puffin	4-5	1
Petrels and shearwaters		
Fulmar	9.2	1
Manx shearwater	5-6	1
gulls		
Herring	5.25	2-6
Kittiwake	3-5	1-3

Dunnet 1982.

- Species

Most seabirds nest in the cliffs and breed in large colonies on islands and coastal areas. Cliff-nesting sites are less at risk from spilled oil on the shore. Different species generally occupy different parts of the cliff for nesting. Puffins will burrow into grassy slopes at the top of the cliff whereas Guillemots tend to breed lower down on the shore. This subjects different species to different levels of risk from spilled oil.

Petrels

***Fulmars* (*Fulmarus glacialis*)**

Fulmars are wide-ranging and aerial in their lifestyle and are probably the species least threatened by oil spills. Evidence strongly suggests that fulmars deliberately avoid settling on a sea surface polluted with heavy oil (Lorentson & Anker-Nilssen 1993).

- General Distribution

Fulmars are most abundant in offshore waters. Fulmar colonies are found mostly on cliffs but low banks and level ground are also used for nesting. They seem less attracted to sheltered rather than to exposed coasts. They are found mostly on the West Coast of Mull and on Staffa and the Treshnish Isles.

Location	**Number of apparently occupied sites**
Treshnish Isles	750
Treshnish point	183
Iona and adjacent islands	169
Dervaig to Calgary Bay	44
Shiaba to Lochbuie	Low numbers

R.Evans pers. comm.

- Feeding

They feed entirely at sea by taking crustaceans, cephalopods and small fish. They grab their food from the sea surface either in flight or by alighting briefly on the water or whilst swimming.

- Breeding

Tend to Breed on the East Coast of Mull from Ardmore point to Carsaig.

Storm Petrel *(Hydrobates pelagicus)*

The Storm Petrel is migratory and largely absent during November to March. It is wide ranging by day in mainly offshore waters and is mainly aerial in nature so is considered to be at low risk from oil pollution.

- General Distribution

This species is named as being internationally important on the Treshnish Isles with 5040 breeding pairs (R.Evans pers. comm.).

- Breeding

The Storm Petrel returns to Britain in April and commences the breeding season with a single egg being laid in late May or June followed by chick-rearing in July and August.

- Feeding

Feed by hovering and then snatch small items from the sea surface.

Manx shearwaters (*Puffinus puffinus puffinus****)***

This species is one of the most numerous seabirds in the Hebrides. It is predominantly aerial and highly mobile which lessens the risk from oil pollution. However their tendency to occur in large groups on the sea surface makes them one of the more vulnerable species to oil pollution.

- General Distribution

Between April and October, the Sea of Hebrides off the western entrance to the Sound of Mull holds high densities of Manx Shearwaters and auks. British and Irish colonies support 90% of the worlds population of Manx Shearwaters. The Isle of Rhum is the most important area for this species in the world. Other colonies are found on Staffa, the Treshnish Isles (300 pairs), especially in the northwest of Lunga and on Cairn na Burgh Mor (LLoyd *et al* 1991), and there are an estimated 1000 pairs off the northwest tip of Mull.

- Breeding

The breeding season consists of pre-laying (March-June), incubation (May and June) Chick rearing (July and August) and fledgling and pre-migration (September and October). When chicks jump off the nest in July and August they cannot fly so are restricted to a few miles around the colony.

The birds' breed along ridges and on mountaintops at over 350 metres and the breeding season occurs during April to August. They are then generally absent from November to February.

- Feeding

They feed at sea entirely on fish cephalopods and crustaceans caught on or near the waters surface at a distance of up to 200km from the nest sites (Boyd & Boyd 1996a)

Divers

Divers would be seriously affected by an oil spill in the region. They spend the majority of their lives on the sea surface and are thus more likely than the more aerial species to come into contact with oil on the water surface.

- General Distribution

Important concentrations of divers occur up to 10km from shore. The coastal waters off the Inner and Outer Hebrides are of major importance from November to April for divers especially Great northerns (*Gavia immer*). Mull wintering population is probably in excess of 40 birds with main sites at Loch Buie, Loch Scridian, Loch na Keal and Loch Tuarth on the west side of the island, but birds also occur along the south and east coasts of the island (R.Evans pers. comm.).

Relatively small numbers of black throated divers (*Gavia artica*) occur off Mull, they are mainly recorded in spring from Loch Buie, possibly relating to migrating birds.

From June to August, red-throated divers (*Gavia stellata*) occur in coastal waters off Northwest Scotland and the Hebrides close to breeding areas they are mainly recorded from Loch na Keal, Loch Buie and Loch Spelve.

During autumn and winter divers spend most of their time on the sea.

- Breeding

They have two moult periods which occur before and after breeding. During one of these they moult flight feathers, leaving them temporarily flightless and making them especially vulnerable. Breeding season is from May to October.

- Feeding

They feed by diving through the water surface for fish rendering them vulnerable to oil spilled on the surface

Cormorants(*Phalacrocorax carbo*) and **Shags** (*Phalacrocorax anstotelis*)

- General Distribution

Cormorants and shags are found primarily in inshore waters. Cormorants are more common in the Irish Sea whereas shags are commoner off the rocky coasts of western Scotland. Cormorants have patchy distribution and are mostly found on the Ross of Mull (Thom 1986). Shag colonies are situated on coastal cliffs of the mainland and on offshore islands such as Staffa and the Treshnish Isles, with a constant distribution over the north, west and south coasts of Mull.

	Apparently occupied nests/ pairs	
Location	**Cormorants**	**Shags**
Treshnish Isles	-	155prs
Treshnish point	-	46
Iona and adjacent Islands	17	93
Fionnphort to Shiaba	55	216
Shiaba to Lochbuie	-	Low numbers
Tobermory to Dervaig	-	93
Dervaig to Calgary Bay	-	82

R.Evans pers. comm.

- Feeding

The birds dive from the surface and swim underwater when fishing and they collect most of their food on or near the bottom rendering them vulnerable to oil both on the surface and which has dispersed and sunk to the seabed.

- Breeding

Relatively few cormorants breed in Scotland. Most breeding colonies for cormorants are on coastal cliffs, rocky stacks and inshore islands.

Gulls

Herring gulls (*Larus argentatus****)***

- General distribution and characteristics

Herring gulls occurred mostly in coastal waters off Western Scotland. Waters near the Inner Hebrides were the most important areas in winter. General distribution includes

the Ross of Mull, Ardmore, Rubh ‘a’ Chaoil, Ulva and Ardmeanach. In autumn there is a southeasterly movement of herring gulls from the Hebrides to Strathclyde and the Moray Firth with a return movement in spring.

Location	**Number of pairs**
Treshnish Isles	345
Islands south of Ulva	305
Erisgeir	168
Loch Scridian	164
Iona and adjacent Islands	1109
Fionnphort to Shiaba	426
Shiaba to Lochbuie	134
Tobermory to Dervaig	418
Eileanan Glasa	122

R.Evans pers. comm.

- Feeding

Herring gulls obtain most of its food by scavenging in the intertidal zone rendering them vulnerable to oil on the shorelines and potentially causing starvation if their food supply is wiped out by an oil spill.

- Breeding

Herring gull breeding colonies occur in a wide range of habitats including coastal cliffs and islands, sand dunes. Concentrations are potentially vulnerable but as they tend to be widespread, local effects of an oil pollution incident are unlikely to affect the population as a whole (Webb *et al* 1990).

Kittiwakes (*Rissa tridactyle****)***

- General Distribution and characteristics

Kittiwakes are found mostly near their colonies in the breeding season with only a few numbers in the deeper oceanic areas. In the autumn between September and November there tends to be a concentration in inshore areas of the western coast of Scotland and off Ardmeanach, the tip of the Ross of Mull and the Treshnish Isles. In winter most birds were further offshore with particularly high densities at the continental shelf break in spring.

Kittiwakes spend more of the year in offshore areas than any other gull. Kittiwakes occur in high densities near their colonies in summer in the Sound of Mull (JNCC 1997). Low densities are found in Erisgeir, Iona and adjacent islands, Fionnphort to Shiaba, Shiaba to Loch Buie and Dervaig to Calgary Bay (R.Evans pers. comm.)

- Feeding

Kittiwakes are offshore, oceanic feeders. They feed on small estuarine fish and invertebrates, which they catch near the surface. They forage in flocks especially in summer and typically gather where shoals of fish rise to the surface. They swoop to the surface and grab food or duck underwater after it.

- Breeding

Kittiwakes breeding colonies are on coastal cliffs and islands. The Inner Hebrides has 23,500 breeding pairs (Boyd & Boyd 1996a). They are not vulnerable to oil pollution because of their aerial habits and scattered distribution. They may be at increased risk in autumn when they join flocks of other species in inshore waters (Webb *et al* 1990)

Great-black backed gulls *(Larus marinus)*

- General distribution and characteristics

Great black backed gulls are less vulnerable than most gull species to oil pollution due to both a highly dispersed breeding distribution and a tendency to occur widely dispersed at sea throughout the year. They are found distributed over most of the coastal areas of Mull.

Location	**Number of pairs**
Treshnish Isles	95
Iona and adjacent Islands	112
Fionnphort to Shiaba	136
Shiaba to Lochbuie	10
Tobermory to Dervaig	12
Eileanan Glasa	35

R.Evans pers. comm.

- Feeding

Great black backed gulls are predators, scavengers and pirates. Their food is obtained by foraging at sea, in the intertidal zone or behind fishing boats, in fields and rubbish tips rendering them potentially vulnerable to oil pollution on the sea or on shore.

- Breeding

Great black backed gulls breeding colonies are found on islands or on top of rocky stacks. Many birds nest as isolated pairs as opposed to nesting in dense colonies and breed in pairs of ten with the largest assembly (100 pairs) found on the Treshnish Isles (Boyd & Boyd 1996a).

Lesser black-backed gulls (*Larus fuscus)*

- General distribution and characteristics

Lesser black-backed gulls are partial migrants in the waters west of Britain. They are present mainly from April to October and tend to migrate south after breeding. They are less numerous than herring gulls and move through the Hebrides in large numbers in spring and autumn. They are found distributed over most of the coast of Mull.

Location	**Number of pairs**
Iona and adjacent Islands	15
Fionnphort to Shiaba	72
Shiaba to Lochbuie	Low numbers
Tobermory to Dervaig	3

R.Evans pers. comm.

- Feeding

Lesser black-backed gulls are opportunistic feeders and mostly feed at sea by scavenging and predating on trawler discards or by surface feeding on fish shoals (Webb *et al* 1990).

- Breeding

Lesser black-backed gulls breeding colonies are found on offshore islands in coastal sand dunes and on islets. They are at a low risk of pollution as little time is spent on the

sea surface during the breeding season. Communal roosting at coastal sites outside the breeding season could expose local concentrations of birds to oil spills.

Common gulls *(Larus canus)*

- General distribution and characteristics

Common gulls are common in the Hebrides but mainly inland, not on the coast or the sea, therefore they are not generally susceptible to oil spills. (Lloyd *et al* 1991). There are 82 pairs are found on Garmony, 112 pairs on Calve island and 73 pairs from Tobermory to Dervaig (R.Evans pers. comm.)

Terns

Inshore waters are particularly important for terns. All species are summer visitors to the area. When breeding, terns feed mainly on sand eels and during the day the birds are absent from the colony, fishing at sea. They are not at high risk from oil pollution due to their largely aerial lifestyle. The greatest risk is on beaches where there may be feeding and roosting concentrations of terns (Webb *et al* 1990).

Common tern*(Sterna hirundo)*

- General distribution

Rarer than the Arctic Tern, the largest British colony of 728 pairs was near Mull in Glas Eileanan (Lloyd *et al* 1991). Low numbers are found in Iona and in Fionnphort to Shiaba (R. Evans pers. comm.).

- Feeding

Feed on marine and freshwater fish and aquatic invertebrates. They fish by plunging through the waters surface from a hovering position.

- Breeding

Nest and breed on coastal areas. The common tern has small colonies of less than 30 pairs in the Treshnish Isles (Lloyd *et al* 1991).

Arctic Tern(*Sterna paradisea****)***

- General distribution

The coastal waters of western Scotland are important for arctic terns, which are the most numerous in Scotland. They use a wide variety of nesting habitats including grassland, dunes and moorland near the coast, offshore islands and inland lochs. They are found off the West tip of the Ross of Mull, on Iona, Ulva and on the coast of the Firth of Lorn from Fionnphort to Shiaba. The greatest threat from oil therefore is if oil washes up on the beaches where they may be roosting.

- Feeding

They feed by plunge diving into shoals of fish and crustaceans just below the surface of the water. Large concentrations are found on the Treshnish isles (c.300 pairs)

- Breeding

Over 1623 pairs breed in Argyll and Bute district (Lloyd *et al* 1991).

Auks

These include guillemots, razorbills and puffins.

Guillemots(*Uria aalge)*

- General distribution

The complex coastline with many islands in this area support many black guillemots Black guillemots (*Cepphus grylle*) are sedentary and tend to remain near their breeding areas for much of the year. During August and September they tend to concentrate in sheltered areas away from strong tides in order to moult. Their nest sites consist of few numbers and are hidden in cliffs or in boulder scree and storm beaches. They tend to be distributed over most of Mull, especially on Staffa and the Treshnish Isles(4780 guillemot and 40 black guillemot individuals). Main concentrations occur in northwest of Lunga between Harp Rock and Corran Lunga. Low numbers are found on Iona and Fionnphort to Shiaba (R.Evans pers. comm.).

- Feeding

Guillemots feed on fish and some marine invertebrates. They feed by diving from the surface to about 20m and swimming underwater. Most breeding birds feed within 50km of their colony although their foraging range just prior to egg laying can be up to 200km. Thus they can be susceptible to oil at sea.

- Breeding

Concentrations near the major colonies in the breeding season and in other areas off western Scotland during the moult period immediately following the breeding season are particularly vulnerable to oil pollution. Most birds' breed in large colonies on steep mainland cliffs of over 30 metres high and on cliffs, level parts of rock stacks and offshore islands. They are at risk as they spend a lot of time sitting on the surface of the water thereby increasing the likelihood that they would have contact with any oil pollution.

Razorbills*(Alca torda)*

- General distribution

Razorbills were most abundant in the waters off Western Mull and in the Sound of Mull during March and April. Outside this period, many birds moved to waters south and east. Small concentrations were present off Southern and Western Mull in July and August and on the Treshnish isles(240 pairs).

- Feeding

Razorbills eat fish and dive from the surface with a flick of their wings and swim underwater to catch fish at depths of 5-7m. Breeding birds can forage 20-30 km from the colony although most feed within a few km (Lloyd *et al* 1991).

- Breeding

Razorbills don't build nests but lay a single egg in crevices or under boulders and usually share colonies with other species of seabird. 80% of the Razorbills were found at colonies in Scotland and Argyll and Bute had 6230 breeding birds (Lloyd *et al* 1991). They are especially vulnerable to oil pollution because of the amount of time they spend

sitting on the surface of the water. Tasker *et al* (1990) placed this species in the highest category of vulnerability to oil pollution.

Puffins*(Fratecula artica)*

- General distribution

Puffins are the smallest of the auks and are only present in small numbers between March and September. The highest densities were found over the shelf area west of the Outer Hebrides and in the sea of Hebrides. The locations of major puffin wintering areas have still not been established. Its colonies are mostly on offshore islands or inaccessible mainland cliffs. General distribution of puffin colonies is mostly in the north west of Mull and are found in nest holes in the maritime grassland of Staffa and on the Treshnish isles (750 individuals).Small numbers are found in Iona and from Dervaig to Calgary Bay.

- Feeding

They feed on fish and marine invertebrates. They dive from the sea's surface and swim underwater after fish which they catch in depths of less than 15m.

- Breeding

Puffins lay a single egg underground in a burrow dug into turf or under boulders. At the peak of the breeding season, huge flocks gather at the breeding colonies. In spring Puffins moult their feathers and become temporarily flightless which makes them highly vulnerable to oil pollution between March and April.

Seaducks

Eider *(Somateria mollissima)*

- General distribution

It is the most common species seen in coastal areas. The highest numbers are seen in November with the main concentrations in the South of Mull and in the Inner Sound.

Birds migrate to the inner sound to moult. In January concentrations were mainly seen off Western Mull.

The Eider ducks tend to be present in sea lochs especially in Loch a Chumhainn, Loch Scridian (which can hold up to 300 birds usually concentrated at mussel farms) and Loch na keal and small numbers at Loch Spelve.

- Feeding and Breeding

They feed by dabbling in shallow intertidal areas and feed on bivalves and crustaceans. The Sound of Iona is their main feeding and breeding ground.

Other birds found include:

Grebes

Little grebes are found on all sheltered coasts south of Mull. Slavonian grebes have a nationally important wintering site at Loch na Keal and are occasionally seen in Loch Scridian and Loch Spelve (R.Evans pers. comm.). Grebes spend most of their time on the surface of the water so are highly vulnerable to oil pollution.

Red-breasted Merganesers

Loch na Keal holds a small wintering concentration of 60-100 birds (R.Evans pers. comm.).

Ringed plover

The majority of nesting pairs of Ringed Plover are found nesting on beaches and high densities nest round the Sound of Iona and they use the shores as feeding grounds during migration. Pairs of breeding ringed plovers in the Inner Hebrides in 1984 were 500 (Lloyd *et al* 1991).

Chough

Cliffs are important habitats for choughs, one pair on Mull are the most northerly breeding chough in the world (Pritchard *et al* 1992)

Migrant and wintering wildfowl

Most important in this region are the island lochs, which act as roost sites to important numbers of passage and wintering geese such as Greenland barnacle and Greenland white-fronted geese. The Greenland population of barnacle geese is becoming increasingly concentrated on inhabited, cultivated islands. The Dutchman's cap in the Treshnish isles support approximately 2% of the wintering population of Greenland barnacle geese. (Pritchard *et al* 1992).

1.2.2 OTTERS

- Species

The only species of otter found in the UK is the Eurasian otter *Lutra lutra*. It is mainly coastal although needs to be situated next to freshwater in order to was salt out of its coat, is slow breeding and is highly vulnerable to factors such as disturbance which might cause sudden population changes. Recovery is slow so is the marine mammal most likely to show both immediate and long term effects of oil pollution.

- General distribution

Distribution in the Inner Hebrides is largely unknown, as not enough surveys have been carried out in this region. It is believed that otters use all coastal habitats although food is less available on long sandy beaches, saltmarshes and exposed cliff headlands than in sheltered rocky inlets. It is unlikely that there is any part of the coastline that is not used at least occasionally by otters but activity is concentrated where the shore is rocky and there is an extensive seaweed zone. The Hebridean population is important because of its size and genetic diversity (Turtle & Meakin 1997).

The highlands and sea lochs of Argyll and Bute support some excellent otter habitat and the long and frequently sheltered stretches of coastline there have a high otter population. The only place otters have been specifically mentioned is in the Sound of Iona Marine Consultation Area.

1.2.3 SEALS

- Species

Two species of seal are common in the British Isles. The grey seal *Halichoerus grypus* and the common seal *Phoca vitulina*.

The Sea Mammal Research Unit (SMRU) carries out annual surveys of all the major seal breeding colonies in Britain.

General characteristics

- Habitat

Grey seals favour remote, inaccessible, waves exposed sites and are associated with deeper, more open water areas.

Common seals however tend to inhabit sheltered inshore areas and use islands and sandbanks as haul out areas.

- Breeding

Grey seals form large breeding aggregations on land between September and November. During spring and summer the nursery islands hold few seals and the breeding grounds above high water have none at all. Males reach sexual maturity at 5-6 years and females at 3-6 years. Subsequent copulation's occur 15-18 days after giving birth.

A mature female can produce up to 1 pup a year, which suckles and remains on shore for 3-5 weeks. During this time pups need to be fed by their mothers approximately every 3-4 hours. Grey seal milk is high in fat so they will put on weight quickly. Between feeding bouts, mothers swim and observe their pups from offshore. Adults do not feed whilst suckling so they may lose up to a third of their body weight during this period which renders them vulnerable to emaciation during an oil spill. Pups are weaned at 16-21 days after moulting from their birth coat to their adult coat and then live off their fat reserves during a learning-to-feed period (Barnett *et al* 1998). Where the seals go at this time is largely unknown, but what is known is that many seals return to the islands to moult in January and February. Males are the first to return to the breeding

grounds, gathering from late July onwards. By late August the heavily pregnant females join the males. The males must have significant body reserves as to retain a position on the breeding grounds they must remain for up to 8 weeks without leaving to feed or drink (Boyd & Boyd 1996a). This is a significant drain on their resources and can render them vulnerable to disturbance during this time.

Common seals do not form large breeding colonies and the pups do not remain on land but instead are born at low tide between mid-June and mid-July and are ready to leave the shore on the first high tide that follows (Gubbay 1988). Males reach sexual maturity at 4-6 years and females at 3-5 years. The mothers are very attentive to their pups, unlike grey seals and accompany them into the water. Pups are weaned at 21-30 days but unlike grey seals are born with their adult coat. Moulting then tends to occur in August. Like grey seals they have to learn to feed themselves and tend to feed initially on shrimp (Barnett *et al*. 1998).

Seals are highly susceptible to disturbance during the breeding season and this will play a factor when deciding on the best method for clean up. Excessive disturbance of mothers and pups on seal pupping beaches by shore clean-up teams may lead to abandonment. Animals expected to be most at risk are fur seals, females with pups and any debilitated seals (Hansen 1985).

- Breeding and Haul out sites

The SMRU undertakes annual aerial surveys of the main breeding sites. The grey seal's summer haul out and breeding sites are concentrated in the west of the region. The main breeding sites being in the Treshnish Isles (the great majority born on Lunga, Fladda and Cairn na Burgh islets and Sgeir a' Chaisteil & Sgeir an Eirionnaich and on Soa island off the Sound of Iona (Duck 1997).

The common seal is not as abundant as the grey seal but significant populations can be found almost anywhere throughout the year. They tend to breed on the sheltered coasts of the Inner Hebrides and their numbers represent approximately 18% of the British population based on numbers of moulting individuals (JNCC 1997). They are often seen around the Sounds of Mull, Loch Spelve, the Sound of Iona and the Treshnish Isles. The

main areas where common seals haul out in August are Ulva on Mull and the south of Ardmeanach within Loch Scridian and Loch Tuarth, adjacent to Lagganulva wood.

1.2.4 CETACEANS

Harbour porpoise and bottlenose dolphins are listed in Annex 2 of the habitats and species directive as being species whose conservation requires designation of Special Areas of Conservation.

- Species

Cetaceans include baleen and toothed whales, dolphins and porpoises. Occurrences are usually related to the fact they annually migrate through the sea of Hebrides (C. Parsons pers. comm.).

The commonest cetacean in the Hebrides appears to be the harbour porpoise *Phocoena phocoena*, which is widely distributed in nearshore waters and seen mainly between July and October. The gestation period is 11 months, calves are born in June and July and are dependent for up to 8 months (Barnett *et al* 1998).

The white-beaked dolphin (*Lagenorhynchus albirostris)* is most frequently seen in June to September and feeds on herring, mackerel and haddock.

Bottle-nosed (*Tursiops trencatus)* has an uncommon peak in April and September. Gestation period is 12 months. Calves are born in the spring and summer (Barnett *et al* 1998).

Risso's dolphins (*Grampus griseus*) breed between April and July and move into waters around the Hebrides from June or July to November. They are frequently seen inshore in summer mainly between March and September.

The common dolphin (*Delphinus delphis*) is often observed offshore and peaks in abundance between May and August (Evans 1997). The gestation period is 10-22

months. Calves are born from spring to autumn and are dependent for up to 19 months (Barnett *et al* 1998).

Minke whales (*Balaenoptera acutorostrata*) are widely distributed in small numbers and sighted between July and October. They eat herring, mackerel and cod and have been known to follow spawning concentrations of these species (Boyd & Boyd 1996b). They have a gestation period of 10 months and calves are born in the winter (Barnett *et al* 1998).

Fin (*Balaenoptera physalus*) whales occur in the Hebrides in late summer and autumn. These species are usually sighted as they pass through the area on migration.

The Long finned pilot whale (*Globicephala melas*) is uncommon and mainly appears offshore between April and September. It feeds mostly on large squid, cod, turbot and horse mackerel.

The Killer whale (*Orcinus orca*) has also been sighted but is uncommon and little is known about its breeding patterns. It ranges widely west of the Hebrides (Evans 1997). It tends to only be seen between May and September and eats porpoises, dolphins, seals, seabirds and fish such as salmon, cod and halibut.

- Feeding

If any of the prey species mentioned are affected by the oil spill then this will obviously affect the cetacean.

The coastal waters of the region form one of the richest areas in the UK for whales, dolphins and porpoises (JNCC 1997). Information on the general distribution and population numbers of cetaceans in UK waters is not at all comprehensive. The Sea based coverage is patchy but is based on stranding, sightings and a few cruises that tried to assess numbers (C. Parsons pers. comm.). Stranding and sightings data are good to give an indication but do not allow any definite statements to be made. Associations between whales and seabirds are a good indicator of distribution. Minke and Pilot whales tend to be associated with Gannets and Kittiwakes. Whales may be guided to

prey by the birds but birds gain more by following the whales as whales drive prey to the surface and within striking depth of diving birds.

Evans (1987) indicated that the most important areas for cetaceans are along the west coast of Britain with particularly good sites around the Outer Hebrides which are important feeding areas for several species during the summer months as well as supporting resident harbour porpoise populations.

Sightings of species:

Harbour porpoises have been seen in and around the Treshnish isles, around Mull and the northern part of the sound of Mull.

The Minke whale occurs regularly around the Treshnish Isles and Northwest Mull in the summer, in an area around Caliach point and off South West of the Ross of Mull.

Risso's dolphins are sighted all round the coasts of Mull.

Killer whales are sighted in the vicinity of Iona, Staffa and the Treshnish isles.

Pilot whales have been sighted off south-east Mull.

Establish the effects oil will have on wildlife and their vulnerability to oil spills as this will have an effect on determining protection priorities

1.3 Effects of oil on:

1.3.1 Seabirds

The effects of oil are dependent upon breeding, behavioural characteristics and season in relation to life cycle. Common effects are hypothermia, drowning, pneumonia, enteritis and starvation.

- Direct casualties

Birds tend to be either killed or disabled by oil. Observation shows that birds appear to take little notice of oil until they swim into it, which remains to be disproved (Bourne 1985). The initial effect of oil is rapid penetration into the feathers causing them to lose their insulating and water-repellent properties and allowing cold water and air to penetrate to the skin. Birds that live on water will lose buoyancy and sink and any attempts to fly will quickly deplete a bird's fat reserves. This leads to increased demands for energy to keep warm and to stay afloat and all leads quickly to the bird

becoming hypothermic and either causes rapid death or forces the bird to beach itself leaving it vulnerable to predators and unable to feed and hydrate.

- Physical exposure

Seabirds exposed to hydrocarbons in oil can become severely anaemic. This in turn decreases the birds oxygen storing capacity and therefore decreases the time it can spend underwater which has an impact on the efficiency of their foraging for food.

- Ingestion

If seabirds preen whilst being oiled they ingest a variety of toxic materials such as polyaromatic hydrocarbons (PAHs). They may also lose the ability to extract water from saltwater and become dehydrated. Once absorbed across the gastrointestinal tract, effects include gastrointestinal irritation, dehydration, haemolytic liver and other liver abnormalities and long term reproductive failure (Leighton 1995). Some oils may also be toxic through skin contact. Birds therefore may die from exposure, drowning, starvation, dehydration, intoxication or stress.

- Food supply

Oil may either inhibit feeding or kill prey causing starvation. This leads to nesting failure and reduced brood sizes. Major spills can directly destroy large numbers of adults and indirectly result in the starvation of nestlings deprived of food.

- Life cycles and reproduction

There is little or no information on whether adult birds ingest oil and pass it to their chicks. Eating oil contaminated food causing changes in timing of the breeding season, nesting failure, inhibits egg production or reduces brood sizes which reduces the rate at which populations can replace losses.

Sublethal amounts of ingested oil may lower reproductive success by depressing egg laying and altering yolk structure hatchability (Grau *et al* 1977).

Lightly oiled birds may contaminate their eggs during incubation and result in lower population recruitment. This especially affects auks, which have low reproduction rates (IMO 1980).

1.3.2 Otters

Little is known about the effects of oil on otters. Following the *Exxon Valdez* oil spill in Alaska in 1989, in which more than 1,000 sea otters are known to have died, 214 carcasses were collected and tested for petroleum hydrocarbons. Of 152 sea otters with external oil present, 66% had interstitial pulmonary emphysema, 55% had gastric erosion and haemorrhage, 42% had both of these lesions. Of 62 otters with no external oil found, 21% had interstitial pulmonary emphysema and 6.5% had gastric erosion and interstitial pulmonary emphysema. From this it was concluded that these were caused by crude oil exposure (Lipscomb *et al* 1993a & b.)

- Ingestion

As otters groom they ingest oil which can cause toxic effects. Sea otters prey on a wide variety of benthic marine invertebrates (Riedman and Estes 1990 in Loughlin 1994). The health problems to otters caused by the ingestion of oil are similar to those of seals and include pulmonary emphysema, anaemia and hypoglycaemia (Conroy *et al* 1997). Potential long-term chronic effects of oiled prey on the sea otter population are of concern but as yet not enough is known about this.

- Insulation

The problem with otters is that, unlike all other marine mammals, they have little subcutaneous fat to aid in reducing heat loss. They are dependent upon air trapped by their fur for insulation which prevents excessive heat loss. The contamination of sea otter fur with crude oil or dispersants reduces this insulation causing saturation of the fur which decreases the natural water repellency of the pelt, and leads to problems with thermoregulation which subjects the animal to hypothermia (Costa & Kooyman 1982, Williams *et al* 1988).

The fur must be continuously groomed in order to be effective at repelling water. Davis *et al* (1988) measured grooming rate of oiled otters and found it increased from 35% to 61%. This continuous need to groom is one of the features that make it so susceptible to oil fouling. Behaviourally, the otter's normal preoccupation with grooming may become obsessive after fouling. So grooming not only makes the fouling worse by spreading oil onto clean areas and rubbing it deep into the fur, it will displace

other behaviours such as feeding, resting and caring for their young (Ralls and Siniff 1990).

1.3.3 Seals

Seals do not seem to be heavily affected by oil pollution. There is no evidence that they were severely impacted by any of the oil disasters so far (SEEEC 1998, Richie & O'Sullivan 1994). Because there is little experience of severely oiled seals it is difficult to determine exactly what the effects will be on them. St Aubin (1990) reported that incidental ingestion during feeding, exposure to vapour concentrations, chronic eye problems and limited surface fouling with relatively fresh oil did not appear to cause significant distress but warns that it may give rise to subtle effects that will only become apparent through long term monitoring.

- Avoidance and Detection

Generally seals will avoid a spill area. However the *Torrey Canyon* disaster claimed 2 or 3 grey seals had been observed surfacing in the oil slick and as many as 12 seals had died (Spooner 1967). Following the sinking of the Amoco Cadiz in 1978, 6 dead grey seals found were covered with oil (Prieur & Hussenot 1978). Seals are well equipped to detect oil. They have acute vision and a good sense of smell (St. Aubin 1990).

- Ingestion

Grey seals tend to feed benthically whereas common seals rely on pelagic prey species (Richie & O'Sullivan 1994). Grey seals are therefore more likely to be affected, as oil spilled will smother benthos. There is no evidence so far that petroleum residues accumulate with repeated exposure however oil fractions are toxic and effects range from acute death to organ damage and other subtle effects may only become apparent after long term monitoring.

1.3.4 Cetaceans

Threats to cetaceans from oil pollution are uncertain. There is little evidence that cetaceans have been killed in previous oil spills and no evidence of any cetacean deaths in the *Sea Empress* disaster (SEEEC 1998). Indirect effects such as the loss of habitat quality and reduction in prey availability will have some impact on the populations in the area but as yet this is unknown.

- Insulation

Cetaceans do not preen fur or feathers so are unlikely to ingest oil or suffer from the effects of hypothermia.

- Inhalation

Cetaceans are air-breathing mammals and must surface from time to time, thus they could suffer toxic effects of inhalation but there is little reliable information. Vapours can lead to lethargy and intoxication (Geraci 1990) and also irritate and damage soft tissues i.e. mucous membranes. Vapour concentrations could reach critical levels for the first few hours after a spill and a cetacean unable to leave the scene during that time could be harmed. For a given exposure, the effect would depend on the health of the animal and its immediate response to stress i.e. a panicking whale would probably breathe faster and so inhale more vapours. Gubbay & Earll (1999b) have reported that volatile hydrocarbons accumulate in tissues such as the brain and liver of mammals causing long term effects such as neurological disorders and liver damage.

- Ingestion

There is virtually no data available on the health effects of hydrocarbons on various species of marine mammals.

Hydrocarbons are toxic but it seems unlikely that a cetacean would ingest much floating oil, however the behaviour of a stressed animal cannot be predicted. Toothed whales (dolphins, porpoises and killer whales) feed on zooplankton which assimilate hydrocarbons from water. Those species which feed on fish are less likely to be exposed to oil concentrations (Geraci & St. Aubin 1980). Oil may have an effect on the prey species, which leads to an increase in competition for food. Low but detectable amounts of PAH's were observed in the muscle tissue of 10 species of marine mammals in

eastern Canada (Hellou *et al* 1990). Therefore it is possible that there could be long term effects due to the bioaccumulation of hydrocarbon residues in body tissues.

- Toxic effects

There is no real evidence of cetacean deaths attributed to oil. Collecting such evidence however is virtually impossible as mammals are only visible for short periods and dead animals may not wash ashore.

- Detection and avoidance

Cetaceans appear to detect oil but not necessarily avoid it. Under experimental conditions bottlenose dolphins (*Tursiops truncatus*) have been shown to detect oil on the surface of the water (Geraci *et al* 1983). Smith *et al* (1983) set up an experiment to see the reaction of bottlenose dolphins to a controlled oil spill and found that all dolphins in the study avoided oil and swam underneath it, surfacing in the clean water.

In most reports of oil slicks they generally appear to be indifferent and do not specifically avoid it, in fact they have been sighted feeding, surfacing and swimming through heavy concentrations of oil. The dolphin's initial reluctance to contact the oil therefore, may have been a natural response to a new stimulus and does not necessarily indicate a conscious avoidance. Within an hour each dolphin emerged in the oil either by accident or as part of an investigative process (Smith *et al* 1983). They were not seen surfacing again in the oil and this aversion could have some consequence in situations where dolphins may become trapped as the only route out is blocked by oil.

Another study was carried out by St Aubin *et al* (1985) who investigated how dolphins react to different viscosity's and colours of oil and whether day or night played a part. In their response the dolphins were presented with three different oils under two conditions of visibility. It was found that overall, dolphins avoided the oil both day and night but it was with the thin sheen of oil that there was no avoidance, suggesting a threshold may have been reached for their ability to detect the oil. It was therefore concluded that irrespective of light, the dolphin's tactile sense played a more important role in the dolphins reaction to oil. This sense will serve them well in any encounter with oil spills at sea and the shown reaction to oil both by Smith *et al* (1983) and St.

Aubin *et al* (1985) confirms reports that cetaceans are not wholly affected by spills at sea.

1.4. Vulnerability to oil spills

1.4.1 Seabirds

- General Distribution

The distribution of seabirds both inshore and offshore is dependent upon season. In the UK, species tend to come ashore to breed between March and June so numbers are highest at these times. Colonies however tend to be above the high tide mark so if oil comes onto shore they tend not to be affected. It is important to know where the colonies are distributed as some birds tend to feed up to a radius of 10-20 miles away from their colonies (Charlie Self pers. comm.). Other birds, such as Terns, oyster catchers and ring plovers tend to nest and feed on beaches. Thus oil on the beaches will affect the feeding grounds so these birds will starve to death.

The work of the seabirds at sea team (JNCC) indicated that gannets, kittiwakes and puffins were widely dispersed during winter and therefore not particularly susceptible to oil pollution then. Guillemots however remain inshore so are highly susceptible (Blake *et al* 1984).

- Behaviour

The most important casualties are auks and diving sea ducks. This is because they spend much of their time on the sea surface and dive rather than fly up when disturbed. Therefore they are likely to surface in a slick and become heavily coated with oil (Clark 1997). Guillemots are the most vulnerable species to oil pollution due to their high numbers and the fact they spend so much of their time on the surface and feed by diving in pursuit of fish.

- Low reproductive rate

Auks and sea ducks have low reproductive rates so it takes longer for the population to recover as they are unable to quickly restore numbers reduced by adult mortality. These species are therefore particularly susceptible to oil pollution and must claim high priority in any conservation measures that are attempted. An oil spill may eliminate a large proportion of breeding adults and potential first breeders so recovery would take an extremely long time. This would have a huge impact (Freedman 1995).

- Lost clutches

Auks are capable of replacing lost eggs and successfully rearing chicks from the replacement provided that relaying takes place as soon after the original lay as possible. Gulls and sea ducks in general have larger clutches so have a greater capability of replacing the lost clutches.

- Moults

Sea ducks are vulnerable during their autumn moult phase when they are flightless. In the course of a normal puffin moult, the primary feathers are dropped and the birds become flightless for a period. In this condition they are particularly vulnerable to oil pollution on shore.

- Population effects

It has been feared that oil spilled on the oceans would destroy seabird populations or at least reduce them to a fraction of their former size. Although losses are unfortunate we must ask ourselves whether there has been a detrimental effect from oil pollution on seabird populations. The answer overall appears to be no. Dunnet (1982) has estimated that there is a natural mortality of over a million birds a year, yet the average annual oil-induced mortality is only in the thousands. The importance of this pollution-related mortality overall on seabird populations is unknown. It has been said that oil-pollution deaths are only removing the surplus birds as it has been noted that colonies wiped out by an oil spill are rapidly re-colonised with the non-breeding segment coming in from the sea. This should reduce the ability of the population as a whole to recover but we have no way of knowing if it has slowed population growth.

- Feeding

Many birds rely on the sea and coast for food and it is this factor that makes them especially vulnerable to oil pollution. Terns for instance plunge dive from the air into the sea to catch fish, this means that if they dive through an oil slick they will become coated with oil (Baker *et al* 1990).

1.4.2 Otters

There is no behavioural evidence, including differences between summer and winter activity, to suggest that otters are more or less vulnerable to an oil spill at any specific time of the year (Richie & O'Sullivan 1994)

- Primarily coastal animals

Coastal regions, especially those in remote areas such as the Inner Hebrides, are therefore very important refuges for otters.

- Strong site fidelity

This leaves them in danger of becoming oil-contaminated, as they will be less likely to move away from the area if an oil spill occurs.

- Feeding habits

They are small and energetic and unable to tolerate interruptions in feeding. They have high metabolic demands relative to other marine mammals and need to consume 20-25% of their body weight per day. They feed on benthic organisms and obtain prey by diving down and then floating at the surface to consume it, rendering them vulnerable to surface oil.

1.4.3 Seals

- Insulation

Seals rely on either blubber or dense fur for thermoregulation. Those with blubber are not particularly affected but fur seals will lose the insulative value of their pelt leading to thermal stress.

Pups have little subcutaneous fat and so have to rely on their birth coat before they have established adequate blubber to keep warm, rendering them vulnerable to hypothermia.

- Eyes and skin

Oil is an irritant to the eyes and mucous membranes and can impair movements of more delicate structures such as eyelids and irritate the cornea. Continued exposure could result in permanent damage. Petroleum fractions remove protective lipids from the skin surface. On exposure to crude oil seals have difficulty in keeping their eyes open and develop severe conjunctivitis, swollen membranes and corneal abrasions and ulcers (Lowry *et al* 1994). As seals have large, protruding eyes they are particularly vulnerable.

- Reproduction

Seals spend much of their lives at sea but occupy land to reproduce and moult. Pups are therefore the most susceptible age group to oil pollution. Most seals are colonial breeders and very large numbers may be exposed to a single oil slick (Baker *et al* 1990). Seals can be vulnerable to oil pollution during their breeding season if oil contaminates their breeding beaches and seal pups may be in danger of suffocation if thick deposits of oil are washed ashore. Grey seal pups are more susceptible to oil pollution than common seals as they stay on beaches for 3-5 weeks after birth. However the loss of a years offspring may be of little consequence in a population with many overlapping generations.

Seals rely on scent to establish the mother-pup bond. Oil coated pups may not be recognisable to their mother and be prematurely abandoned (Gubbay & Earll 1999b). A

more serious problem might be if females were loath to abandon pups when threatened by major oil pollution (McLaren 1990) causing them also to be coated in oil.

- Site fidelity

Seals are selective in their choice of breeding ground and for that reason entire life histories feature seasonally synchronous reproductive activities at well established sites (McLaren 1990). This may involve long distance homing, from feeding grounds to massive breeding colonies, with risk of exposure to pollutants. Added to this again is the likelihood that some individuals may refuse to abandon areas that have been contaminated.

- Habitat

Physical characteristics of a habitat could influence the way in which a seal contacts oil (McLaren 1990). Oil on a sandy shore is readily rubbed into the seals coat although clean sand can cleanse the oil off by adsorbance and abrasion. Smooth rocky shores might receive only a thin coating of oil during a major spill although depressions and tide pools could accumulate oil leading either to smothering or sequestering the oil away from contact by seals.

- Inhalation

Because seals are air-breathing mammals they are required to surface in order to take a breath. When breathing they barely raise their nostrils above the level of the water rendering them particularly vulnerable to hydrocarbons and other chemicals evaporating from the surface of a slick. Direct inhalation of toxic chemicals such as the mono and poly-aromatic hydrocarbons (PAH's) present in crude oil which evaporate off in the first few days of a spill can cause multiple problems. Local inflammation of mucous membranes of the respiratory tract, followed by possible pulmonary haemorrhage and general congestion tend to be seen. (N.Gutteridge pers. comm.)

- Feeding and Ingestion

Significant amounts of hydrocarbons would probably not be consumed by seals as it has been observed that although they scratch themselves with their flippers, they do not seem to mouth or lick themselves and also none of their prey has accumulated

hydrocarbon residues (McLaren, 1990). When ingested, crude oil can lead to a deterioration in digestive function and gastro-enteritis (N.Gutteridge pers. comm.). Those animals compromised by pre-existing disease are particularly vulnerable to this.

- Systemic damage

Systemic damage can be varied, extreme and fatal. Damage to the hepatic and renal systems which attempt to break down the oil can be severe. Laboratory studies on phocid seals have demonstrated that the blood may transport petroleum hydrocarbons and distribute it to many tissues including blubber, muscle and liver (St Aubin 1990).

Besides liver and kidney damage, the central nervous system is also affected. Lesions in the CNS caused by the hydrocarbons are thought to be responsible for disorientation, depression, excitation and aberrant swimming behaviour (N.Gutteridge pers. comm.). This damage is fatal.

1.4.4 Cetaceans

- Site fidelity

Cetaceans show strong site fidelity. This strong attraction to specific areas may override any tendency for a cetacean to avoid the noxious stimuli of oil. Although most species do have the flexibility to search out new areas when old ones become unsuitable.

- Migration

Many cetacean species migrate, potentially exposing them to spilled oil along the route. As migration is a necessary event, oil may change this pattern but is unlikely to override the impulse.

- Surface contact

Cetaceans have no fur thus loss of insulation is not a concern. The cetaceans skin acts as a barrier to the noxious substances found in petroleum, so there is only transient damage to cells (Geraci 1990). If the skin is broken however, oil does not impede healing but may introduce pathogenic micro-organisms.

- Feeding

Cetaceans that feed at the surface and on the seabed are more at risk of ingesting oil than those that feed in the water column. Concern is that oil may adhere to the baleen plates of Baleen whales so as to block the flow of water and interfere with feeding. there is however no evidence of this (Geraci 1990).

2. Establishing priorities for protection.

Now that we have addressed the species present in the area and assessed the general impact that an oil spill will have on them, we can begin to set priorities for protection. This is difficult to determine. Different groups will have different interests and priorities will change depending on the type of oil spilt and the tide and current direction. Seasonal variations such as breeding or migratory seasons and other variations such as tourism will also have to be taken into account. Since it will not be practical to respond to every mile of shoreline then the following points have to be taken into consideration:

1. How desirable is the protection of a particular resource?

In order to establish priorities it is important to locate sensitive areas i.e. commercially productive areas such as fish farms, breeding sites, migratory routes and rare and vulnerable habitats (see 2.1).

2. To what extent is this protection practical.

It is important to take into account competing demands. A forum would have to be set up to bring the interested parties together. (see 2.2)

3. Availability of local knowledge
4. Variations in priorities

2.1 Locating sensitive areas.

- Productive areas- i.e. fishing areas (this is not within the scope of this project)
  i.e. amenity areas (not within the scope of this project)

- Breeding sites- locations along shoreline or in water where breeding aggregations of animals form e.g. seal breeding sites, seabird colonies and feeding areas. The importance will be determined to a large extent by the percentage of the population that use it, its degree of isolation from other sites and the number of other breeding sites that exist.

- Migration routes- used to move from feeding to breeding areas. i.e areas where cetaceans are sighted. Importance depends on the geographical flexibility, percentage of overall population and the time span of use.

- Rare and vulnerable habitats

These include:

-Ramsar sites

None on Mull but they are present in the rest of the Inner Hebrides

-Natura 2000 sites

- **SPA** *(from EC directive on the conservation of wild birds 1979 which requires special measures for bird habitats and wetlands)*

- The Treshnish isles are an SPA.

- **Potential SAC's** *(to conserve biodiversity across the EU).*

-These include Ardmeanach and Gribun Shore and Crags (L. Mcteague per com)

- **SSSI**- areas of special interest by reason of their flora, fauna, geographical or physiographical features (see appendix 1).

- **Marine Consultation Areas**

The Sound of Iona

- **National Scenic Areas**

-Loch na keal, Mull

- **Environmentally Sensitive Areas**

The whole of the Isle of Mull is declared an Environmentally Sensitive Area.

An attempt should be made to locate all these sensitive areas on a map. It is important to develop environmental sensitivity maps to help streamline decision-making. These maps should be prepared for each season with indications of which particular species are most likely to be present with respect to reproduction, migration and feeding behaviour. This has been done to some extent with the Nature Conservancy Council Maps (1990). Up to date data is not generally available.

Environmental sensitivity indices can be used as a basis to help agree on priorities for protection. However there is a lot of controversy with these indices, with many researchers dismissing them as suspect. When deciding on priorities for protection it appears that they are scientifically based. However it should not be up to science alone

to dictate the priorities. Science is not necessarily objective. Every scientist has a particular fondness for a certain species or habitat. For instance, a particular group of scientists who are responsible for deciding these indices may be interested in birds. Thus it is inevitable the sensitivity index will be biased towards birds which may not be a true indication of sensitivity. Sensitive areas should be developed and agreed upon by a group of people who all have an interest in establishing priorities and will all participate in agreeing on the best areas for protection. The way to do this would be to set up a forum with the groups mentioned in section 2.2.

2.2 Identifying competing demands

Different groups will have different sets of priorities for protection. For practical purposes this author feels that determining the priorities for protection cannot be down to one person. It would be arrogant to assume that priorities can be determined without taking into account the other user groups. Those groups with an interest include the public bodies and the local interest groups.

2.2.1 Public bodies

- Local council

The local council would be concerned about:

1. Tourism and amenity areas such as beaches, bathing enclosures, water sport and game-fishing areas.
2. Economic areas such as commercial fishing areas, seaweed cultivation areas, important migratory routes such as estuaries, marinas and industrial facilities such as desalination plants or water intakes for power stations which will all be affected by an oil spill.

- Scottish office

The Scottish office will be primarily concerned about areas where fish and shellfish may be threatened.

- Crown estate

The crown estate would be concerned about all aspects for protection, commercial areas, amenity areas and also wildlife sensitive and environmental areas.

- Scottish Natural Heritage (SNH)

SNH is concerned about issues affecting the natural heritage of Scotland. It would be concerned with protecting wildlife and landscape areas especially those designated as SSSI, SPA or SAC's

- National Trust for Scotland

Concerned with National Trust sites and species or habitats on their properties which may be affected i.e. Iona, Staffa, Burg

- Scottish Wildlife Trust

Concerned with important wildlife areas

2.2.2 Other interest groups

- Environment groups

Would be concerned about protection of the resource they are representing i.e.

- Hebridean Whale and Dolphin Trust

Would be concerned with sensitive areas such as breeding sites and migratory routes of whales and dolphins.

- RSPB

Concerned with important bird feeding, resting and breeding areas especially those containing rare breeding birds, susceptible to long term effects, such as auks, or those which have international or national importance such as the Storm Petrel (Treshnish

Isles) or the Common Tern (on the Sound of Mull) also areas which are listed as being important for over-wintering barnacle geese and red and black throated divers.

- Tourist board

Would be concerned with amenity areas such as beaches. Tour groups that carry out wildlife sighting tours such as whale watching or coastal walk groups would obviously be concerned about these areas.

- Local businesses

Concerned as a drop in tourism would affect local businesses and also any adverse publicity would prevent people from buying produce from that area even if it was not affected by the oil.

- Fishermen

Concerned with protecting their livelihood.

- Local residents

Those that dive, surf, go recreational fishing or sailing would all be concerned that these areas receive the highest priority for protection.

2.3 Availability of local knowledge.

When establishing priorities for protection it is important to take into account local knowledge. Priorities should not be just for the experts who have probably never visited the area to decide on.

2.4 Variations in Priorities

Provision should be made for the response priorities to be altered if resources are impacted by a spill before the plan can be implemented.

Issues which need to be addressed include:

- Species biodiversity/rarity

What species would suffer the greatest loss i.e. see table 1. Those species which lack the potential to quickly replace losses and have low breeding success, will be highly impacted by an oil spill and need greater protection. Other species which are limited in numbers will be a priority i.e.

Table 2: **Marine priority species In Argyll and Bute**

Species
Fan mussel *(Alrina fragilis*)
Native oyster *(Ostrea edulis)*
Northern Hatchet shell (*Thyasira gouldi*)
Sea pen (*Tuniculina quadrangularis*)
Sea squirt (*Styela gelatinosa*)
Allis shad (*Alosa alosa*)
Twaite shad (*Alosa falla*)
Common skate (*Raja batis*)
Basking shark (*Cetorhinus maximus*)
Commercial fish species (Atlantic salmon)
All baleen whales
All toothed whales
All dolphins
Harbour porpoise (*Phocoena phocoena*)
All turtles
Grey seal (*Halichocus grypus*)
Harbour seal (*Phoca vitulina)*

M.Burrows DML pers com.

- Vulnerability

How long would it take for the population/ area to recover i.e. the recovery rate of the population indicates its vulnerability. Recovery is defined as 'the re-establishment of a healthy biological community in which the plants and animals characteristic of that community are present and functioning normally' (Baker *et al* 1990). Recovery rate will inevitably depend on factors such as reproductive potential of surviving organisms, the potential for migration of animals back into the affected area, availability of early developmental stages to re-establish the population as well as the severity of the disturbance. The value of protecting an area of saltmarsh over a rocky shore is a good example. The impact on rocky shores is likely only to be temporary. Populations are

highly adapted to rapidly changing conditions and wave action will minimise oil contact. The animal populations may leave the area for a while but once the oil has been removed will return. The recovery rate for saltmarsh on the other hand will be slower and may be there for hundreds of years as it will remain trapped and the degradation process is slow. Similarly recovery may be slow for those species with low reproductive potential such as sea birds and mammals (see table 2). Any habitat with low recovery potential is going to have a high priority for protection. i.e.

Table 3: Marine priority habitats in Argyll and Bute

	Habitat
Littoral sediment	Mudflats
	Sheltered muddy gravels
	Seagrass beds (*Zostera nolti))*
	Ascophyllum machaii beds
	Saltmarsh
Inshore sublittoral rock	*Modiolus modiolus* beds
	Tidal rapids
Islands and archipelagos	Hard reefs
Inshore sublittoral sediment	Seagrass beds (*Zostera marina)*
	Maerl beds
	Saline lagoons
	Mud in deep water
	Serpula vermicularis reefs
Offshore shelf sediments	Sands and gravels
Supralittoral rock	Maritime cliffs and slopes
Supralittoral sediment	Coastal sand dunes
	Machair
	Coastal vegetated shingle

M.Burrows, DML. Per com.

- Societal values

What values does society place on the species or habitat. When deciding on priorities for protection factors such as commercial, recreational, ecological and aesthetic values need to be taken into account. Human use of the resources such as fishing, bird watching, sailing and sunbathing will all play a part. Amenity areas such beaches may have a higher societal value than an area of saltmarsh even though saltmarsh is in the

list of marine priority areas. The same can be said for certain species. Society places a greater value on species they can relate to such as dolphins and seals. Species in the area (see table 2) that have been declared as being vulnerable have not been heard of by many people.

Therefore we need a set of questions to be asked to determine vulnerability of a species and its priority:

a). Is the oil going to occupy an area of the sea/shoreline that is presently occupied by a seabird, or seal population?

b). Is the area exclusive or essential for this population?

c). Is the species threatened or endangered, so damage to a given population could be critical to species survival, i.e. is the species protected under any laws?

- Scotland holds 40 of 175 species listed in Annex 1 of the EC birds directive. 61 of 86 species in schedule 1 of the wildlife and countryside act and for 57 species, Scotland holds 75% or more of Great Britain's breeding or wintering population (SNH pers com).
- Both species of seal are regarded as vulnerable at European level and are protected by the Bern convention on European wildlife and Annex IIa of the Species and Habitats directive as well as under national legislation. Under the Conservation of seals Act 1970, killing or taking of common and grey seals is an offence.
- All species of cetaceans have legal protection in great Britain under section 9 of the Wildlife and Countryside Act 1981 which specifies that protected animals should not be killed, injured or taken (within UK territorial waters), possessed or sold. Permits are therefore needed for any relocation of cetaceans after an oil spill.

d). Are the individuals expected not to avoid oil exposure either voluntarily or by circumstances? i.e. seabirds may unwittingly dive into the oil when feeding, seal pups and mothers may get caught on shoreline if oil is spilled during breeding season and cetaceans tend to avoid oil unless they get trapped in bays or estuaries.

e). Is the oil going to cause species to be displaced from a critical habitat, cause direct toxicity through ingestion, or loss of an important food source?

If any of these answers are positive then these species need special consideration for protection. This needs to be determined along with shoreline types taken into consideration but is not in this project due to time constraints.

3. Facilities available for wildlife response

3.1 Information on local resources and capabilities.

The contingency plan for every high risk area should include details of where a response centre would be located, who would provide the facilities and equipment, location of accommodation, catering etc. Keeping workers near the spill site significantly improves the amount of time spent directly searching shorelines for wildlife.

Are there any facilities or supplies available? Any areas for temporary rehabilitation facilities with electricity, hot and cold water, heating and ventilation, food and care supplies.

- *Details of where a response centre would be located*

The most obvious place for a response centre would be at the Coastguards office in Oban. This office has an emergencies room and has adequate communication facilities and maps to aid in a response. The only drawback is that it is not on the island and benefit would be to set up a temporary office on the Isle of Mull. The possibilities of where the response centre would be have not been addressed in this project but a village hall, scout hall, school hall or similar would probably be suitable. A large area is needed for offices for all the participating groups and a switchboard for communications.

- *Who would provide the facilities and equipment.*

On-shore response is the responsibility of the local authority who shouldorganise the facilities and equipment for response.

- Mull has no protective clothing for local handling of birds and wildlife.
- There are no local dispersant stock piles on Mull.

- *Location of accommodation, catering etc.*

Mull has a wide variety of accommodation available. Lists can be found in the local telephone directory. It is likely that there will be offers from locals for accommodation at their houses should the need arise, but this is something that cannot be determined until an actual oil spill occurs.

4. Personnel

Central co-ordination under a single organisation which has complete responsibility for handling the operation is normally the best solution. Where this is not possible and more than one organisation is involved in responding to a spill procedures for co-ordination between the various groups must be laid down. The size of the organisation depends on the area covered by the plan, the severity of the threat and the sensitivity of the resources threatened. Clean up of wildlife involves more interests and typically demands greater co-ordination than other responses.

- Mull does not have the labour force necessary to carry out a clean up without outside personnel coming in.

Personnel responsible for wildlife should be nominated to be:

- Response co-ordinator

-Oversees wildlife response operation

- Search and collection co-ordinator

-Co-ordinates search and collection program.

- Wildlife rehabilitation co-ordinator

-Co-ordinates and oversees the housing, washing, rinsing, nutrition and general care of animals during a spill event.

- Volunteer/logistics co-ordinator

Organises and schedules volunteers on a daily basis. Schedules and conducts orientations and safety training as needed. Handles volunteer issues and problems and reports them to response co-ordinator. Handles logistics such as travel arrangements, vehicle rentals, staff and volunteer meals, supply ordering.

- Environmental advisor

Responsible for continuously assessing damage and potential damage to the environment.

- Disposal advisor

-Responsible for providing expertise in disposing of oil and oiled carcasses in a safe and efficient manner.

- Communications advisor

-responsible for establishing an effective communications network at spill site

- Transport supervisor

Obtain necessary vehicles and utilise them for efficient transportation of personnel and materials at spill site.

4.1 Roles and Responsibilities

4.1.1 Identify personnel involved and their responsibilities.

There needs to be a clear leadership role. The management of the wildlife response will inevitably fall to the SSPCA. They have more capabilities, facilities and trained personnel than any other animal welfare organisation. However, all agencies involved should be involved in contingency planning.

One of the major problems in oil spill response is who is responsible for what. If people are not clear what to do then tasks will be overlooked. There needs to be a clear understanding of responsibility for the wildlife response and personnel who may not have practical part to play but can provide necessary advice and back up.

A list of wildlife organisations and individuals who should be contacted when writing a contingency plan should be drawn up.

This list should mention:

- government groups,
- advisory groups,
- oil authorities and contractors,
- groups involved in rescue,
- wildlife centres,
- research organisations,
- local wildlife groups and individuals,
- local useful contacts
- and countrywide wildlife groups that could be contacted

See appendix 2 for list.

4.1.2 A local Wildlife response co-ordinating committee should be established as soon as possible.

This group should be set up with the local authority, police, coast guard, SSPCA, RSPB, local vets, SEPA , SNH and other local wildlife groups (see appendix 2).

4.2 Outline of strategy for personnel to follow.

1. Initial report of oiled wildlife.
2. Set up a planning committee to assess suitable techniques of clean up from technical view point.
3. Check maps to assess coastal access and sensitivity
4. Ring SNH, RSPB, SSPCA etc and get advice
5. Achieve consensus of opinion on clean-up methodology
6. Ring wildlife centres to inform them of likelihood of intake.
7. Mobilise clean up

- *recommendations:*

Proper organisation of work force is essential and chains of command formulated.
There is a need to rotate key personnel to minimise stress and conflict with other work commitments.
- Affected coastline should be divided into smaller areas.
- A supervisor should be assigned to each area with a group of volunteers divided into teams.
-Each team should not contain more than 10, with 5 generally being the optimum number.
-Each supervisor should be responsible for no more than 100 people i.e. 10-20 teams.
-Each team should be allocated a section of the beach to search, the size of which being set so it can be searched within a given time period and beach search forms should be issued with information to be collected (see appendix 2).
-Access to some sites may need to be restricted to minimise damage to shorelines and conservation areas.

- On tidal shores- work should be arranged round tides with rest periods and meal breaks taken at high water. Night-time working is usually found to be inefficient.

4.3 Training of personnel

The RSPCA has trained volunteers and should maintain a list. BDMLR are running marine mammal rescue courses.

5. Equipment

Clean up and wildlife rescue will occur in areas with poor or no road access and the range of shoreline and coastal habitats prevent large boats from coming ashore. Waste material will probably have to be airlifted off the beaches using helicopters.

5.1 Identifying manpower, equipment resources and location available.

Extent to which the requirement can be met from the organisation implementing the rescue will depend upon availability, techniques involved and amount of specialised equipment to be deployed.

The Argyll and Bute council has a list of available equipment for shoreline clean up, hence this is not covered in this study.

Once local personnel involved have been identified, questionnaires should be sent out to find out about local resources. Due to time constraints this was not possible.

- procedures for mobilisation and release.

The counter-pollution branch of MCA, or co-ordinating groups such as the SSPCA will phone the relevant authorities to mobilise equipment. Times taken to mobilise the equipment would be useful to be worked out.

- airstrips are located at Glenforse. But there is no problems with landing helicopters in Mull as there are vast open spaces, the school field in Tobermory should be considered.

5.2 coastal access points and types of shoreline.

- Factors to be taken into account include whether beaches are easily accessible for heavy equipment and the ability of the beach to support such vehicles.
- The South Coast of Mull is virtually inaccessible (Steve Monks pers. comm.).

- Maps attached to the operational plan can be used to show the areas where coastal access points are, the type of shoreline and where restrictions might apply. Other information that should be detailed is location of airstrips, temporary storage and disposal sites, fisheries and water intakes.

- Owners of the land will have to be consulted to allow access.
- Presence of protected areas will affect access and movement of vehicles to shorelines.

6. Response decisions

6.1 Assessing presence of wildlife

Specialist survey teams should be put together to assess effects by land, air and water and report any sightings. Teams should note species, number and indications of condition, video footage would be useful (Gubbay & Earll 1999a).

Information in the plan should include areas where such assessments could be focused.

6.2 Factors to consider before collecting and cleaning oiled wildlife

- To what degree is a colony or a species threatened by losses? i.e. if a bird population is likely to suffer long term effects then more effort should be put into cleaning and rehabilitating this species
- What is the availability of resources i.e. is there any centres nearby to cope with oiled birds, seals or otters. Are those facilities or supplies available? Any areas for temporary rehabilitation facilities with electricity, hot and cold water, heating and ventilation, food and care supplies.
- Is there an organisation or individuals knowledgeable in correct methods for treating oiled wildlife?
- What is the availability of a supervised labour force to conduct rescue and treating effort? Adequate staff is essential. Groups should be identified to assume this responsibility.
- Where is the oil spill. In remote and inaccessible areas it may be impossible to implement a rescue effort in which case oiled wildlife should be humanely killed.

6.3 Facilities to take oiled wildlife

See appendix 2

7. Rescue and Rehabilitation

7.1 Oiled birds

The group in charge of oiled bird rescue and rehabilitation is the RSPCA/SSPCA.

7.1.1 Beach Searches

Decisions on how best to deploy beach teams will be based on aerial surveillance reports and direct reports from the public. All beaches should be reported and a form filled in (see appendix 2)

Rescue teams should consist of two or more people. A plan of action should be discussed beforehand and a central field stabilisation site where oiled birds are brought to after collection should be established. Each capture site should be evaluated and strategies developed to suit the terrain and species involved. Two way radios and cellular phones are often used to communicate between search and collection teams.

7.1.2 Collection

This can be carried out either by boat or by hand. Response plans tend to focus on cleaning up of wildlife when it comes ashore even though it is when the bird are out at sea feeding that problems mainly arise, particularly if they dive into the water to collect food or spend long periods sitting on the surface.

Boat collection however has been argued as being a bad idea (SEEEC 1998). The report describes people chasing birds around in the boats. Not only is this stressful to the birds, it may cause severely oiled birds to dive or fly away and be driven back into the oil rather than away from it.

British protocols recommend that birds should be allowed to beach naturally and then approached from the seaward side to discourage them turning back to the sea (RSPCA).

- General procedures

Only those who are properly prepared and trained should clean and rehabilitate birds. People without training may assist in collection of still living oiled birds. Guidelines for this are:

1. Collection and initial handling should be carried out in a way that minimises stress to the bird. Keep chasing to a minimum and as capture from boats is usually inefficient, it is easiest to wait till they come ashore.
2. Always approach birds from seaward side to avoid them being scared back into water.
3. Long handled nets should be placed in front of the fleeing bird or cloths thrown over the bird to aid in capture.
4. Gloves and goggles are recommended to prevent injury.

   Birds should always be held firmly but gently to prevent wing flapping. A bird should never be grabbed by the neck as this may cause injury. Most birds are restrained by placing a towel or sheet over the bird, holding the head behind the neck and holding the wings to the body. Keep the birds at waist level to avoid injuries to the handler's face. Avoid lifting and holding by the wings only.

   Birds can be moved or handed to another person by transferring first the body, then the head.
5. Each species possesses special traits that may affect the capture situation i.e. puffins and gulls bite and will crush and twist flesh resulting in painful bruising injuries to the handler. This should be addressed before capture commences.
6. Oil should be removed from the bill and nostrils with a cotton swab or cloth. Removal of the oil with spirits should not be attempted.
7. Birds should be placed in an individual, well-padded and ventilated cardboard box with the flaps closed to keep the bird in the dark. The box should be twice the size of the bird, lined only with newspapers or rags and with holes for ventilation. Sawdust or other organic materials such as hay or straw, should not be used as these may provide secondary infections such as asperigillosis, a fungal infection of the respiratory system (RSPCA a). The bird should also not be wrapped up as it may overheat. On the box should be written the location of capture (so it can be released in its own area after care if possible), the reason the animal was captured and any factors which may have caused its injury, species, date and time of capture and the name of the person who captured the animal.
8. Birds should be taken quickly to trained personnel. Transport vehicles must have adequate ventilation to protect both humans and animals from inhaling oil fumes. Animals should be monitored periodically on long journeys, the temperature of the

vehicle should be kept constant and it may be necessary to give an electrolyte solution periodically to help rehydrate the bird.

Selection of techniques and lessons learnt.

- Oiled birds come ashore at night so searches should be conducted in the early morning (Clark *et al* 1997).
- Important to pick up oiled carcasses to avoid secondary poisoning of predators and scavengers.
- The RSPCA does not advocate covering the birds in cloths or ponchos to prevent them from preening and ingesting more oil. In their experience it often causes more problems than it solves. (RSPCA a)

7.1.3 Selection

Birds must be assessed to see if they are suitable for transport and cleaning or whether they should be humanely destroyed. This decision will no doubt cause controversy and resistance from public and volunteers. The correct procedure should be reviewed at the time of the spill. It may be possible to treat small numbers with a reasonable chance of success. However if large numbers appear, a more rigorous selection is going to have to be made despite probable public outcry.

The RSPCA have drawn up criteria for selection in this event:

Birds with a poor chance of survival should be humanely destroyed, placed in body bags and into the freezer. These are:

- Birds which are severely underweight, i.e. with the keel bone protruding.
- Birds with glazed eyes and slow movement of the nictitating membrane- this usually means a bird is in poor body condition.
- Weak birds that are unable to stand with a pronounced arching of the lower part of the back which is usually a sign of poor internal condition.
- Birds which are haemorrhaging.

Birds with a good chance of survival are those that:

- Have the ability to stand up
- Be generally alert and lively i.e. attempt to escape from the box.
- Be aggressive
- Show a round bright eye
- Have a good body condition
- Have a strong wing beat.

7.1.4 Initial first aid

Once selected:

1. Wipe the birds beak and eyes with kitchen roll or tissue and the inside with a cotton bud. Excess oil and water should be removed from the body.
2. A solution of activated charcoal (BCK) to absorb oil and glucose (lectade) to counteract hypoglycaemia should be administered via a stomach tube. Replacing fluids is important to prevent dehydration. The benefits of this were shown in two separate oil spills where in the first no fluids were administered and survival rate was 44%. In the second incident the birds were tube fed with neobiotic, lectade and kaogel before being boxed up and dispatched to the cleaning centre. The survival rate this time was 66% (Clark *et al* 1997).
3. Birds should be placed into cardboard pet carriers with newspaper, adequate ventilation holes and kept dark to calm the bird. If possible place veterinary cat collars around the necks to prevent preening.

7.1.5 Transport

Ideally birds should be in a stable condition, fed, watered and kept warm before being subjected to the stress of further travel. However if adequate facilities cannot be provided on site it is preferable to transfer as soon as possible. The RSPCA have guidelines for setting up a temporary cleaning unit if the journey time is likely to exceed 3 hours. This should be maintained by an experienced Inspector.

- Guidelines (RSPCA pers. comm.):

It is essential to obtain detailed information prior to a spill about resources and capabilities. These guidelines identify a list of possible personnel and sites that could be contacted in the event of an oil spill to find out if they have any resources available (see appendix 2). Checking sites was not possible due to time constraints but the identified facilities should be contacted and questionnaires issued to find out if they are suitable.

1. A suitable facility for the cleaning unit should be identified, e.g. a community centre, church hall, scout hall, barn.

Facilities should have:

- A good water supply capable of delivering 1500 gallons of water per hour (each bird requires 150 gallons for the wash/rinse process). This supply would have to be a mains supply.
- foul drain capable of coping with oily waste. Check with local environmental health department.
- a mains supply/generator
- easy access for vans and skips etc.
- Must be large enough to provide space for a reception area, pre-wash area, wash area, drying area, pool area (for fast tanks), feed preparation area with freezer (for fish), store area (newspapers, mops etc) disposal area with freezer (for carcasses), office and staff room.

2. A reliable and well-stocked fish supplier should be identified.

3. Suitable volunteers should be identified. The RSPCA should have a list of experienced volunteers that have previously helped out during oil spills which could be called on. The skill of joiners, plumbers, electricians can also be used.

4. Suitable accommodation should be identified for the personnel.

5. Catering should be organised to feed the volunteers' i.e. the local WRVS.

7.1.6 Intake procedures

1. Centres should be notified of quantity and species of incoming birds so appropriate holding pens and equipment can be made ready.
2. Leg bands should be fitted to each bird on arrival and an individual record form started.
3. Type of oil (if known), percent oiled and depth of oiling should be recorded.
4. Excess oil should be removed from eyes, mouth, nostrils and anus
5. An initial physical examination should be carried out to ensure the bird has no broken bones or abrasions. Check for irritation of mucous membranes, inflamed skin, tremors and convulsions.

- Record weight of bird, temperature and heart rate should be recorded.
- Look for eye, nostril or mouth discharge and abnormal head tilts (CNS problem).
- Palpate wings and legs for fractures, wounds or swelling, abnormal wing droops or leg lameness
- Check body for keel lesions and muscle loss.

6. Obtain an oiled feather sample and place in aluminium foil and label with date, species of bird, ID band number and spill name. Place in freezer for legal evidence.

7. Give warm oral fluids (1-teaspoon BCK granules to 100mls lectade) via a stomach tube.

8. Blood tests should be carried out to determine treatment protocols whilst in rehabilitation. This is only practical if small numbers of birds come ashore. Tests should be for blood glucose (hypoglycaemia), packed cell volume and total blood solids. Various oils affect different species in different ways so if a bird is found to be seriously anaemic then euthanasia should be considered.

9. Place in a well-ventilated, newspaper lined cardboard box in a quiet area. Food should not be given initially to the birds as feeding increases the absorption of toxins from the oil in the gut. Instead they should be dosed with liquid vitamin and mineral supplement i.e. B vitamins and iron to stimulate the birds appetite (Clark *et al* 1997). Later they can be fed with fish (sprats or whitebait) in salty water.

10. Trained personnel should then conduct the washing and training programme.

7.1.7 Cleaning and rinsing

There is no immediate urgency to clean the oiled birds as long as they can be prevented from preening. Oiled birds should not be washed immediately after capture, the advantage of delaying cleaning until the birds are stable and have regained weight must be set against the risk of damage caused by oil ingested through preening (RSPCA a).

Priority should be given to cleaning aquatic birds such as auks which are unable to stand for long on hard ground and will develop arthritis, or scoters and divers which will develop breast lesions if kept out of water for more than 1-2 weeks (Clark *et al* 1997).

Rinsing detergents from the feathers is as important as removing the oil. Detergent left behind will not allow feather components to integrate to provide water repellency and birds will have to be kept in captivity for longer before their release which will affect their survival rate.

The material that has fully satisfied the criteria of effective oil removal and being readily available is domestic washing up liquid i.e. fairy liquid. It can be used in hot water, an added advantage as the detergent is more effective but also the birds are not exposed to thermal shock.

- ***Protocols for cleaning oiled seabirds (Clark et al 1997)***

Cleaning procedures are at their best professionally carried out as a number of well meaning organisations have attempted to rescue and treat oiled seabirds in the past in quite inappropriate ways. Cleaning an oiled bird requires patience, determination and two people, one to hold the bird while the other cleans it. The RSPCA should be at the forefront of all cleaning and training of volunteers.

1. The birds are placed in a tub of hot (40-45°C) water and have the beak cleaned inside and out with a toothbrush. The beak is then secured with an elastic band taking care not to cover the nostrils.
2. The area surrounding the eyes and beak is then washed well with the toothbrush.
3. The plumage is cleaned starting with head and neck and continuing down the back. Feathers are cleaned in a sideways fashion to avoid damaging the feathers.
4. The bird is turned on its back and the throat and breast scrubbed well to penetrate the thick plumage. Then the flanks and underside of the wings are washed. The feathers should show no visible traces of oil by the completion of cleaning. water should be changed as often as necessary.

5. The bird is then rinsed in a tub of clean hot water.

6. The bird is then proofed using a high-pressure jet of hot water sprayed 'under and against' the lie of the feathers till water droplets flow off the feathers.

7. The birds are roughly dried with a clean cloth and transferred to the drying room.

7.1.8. Post-cleaning

- Drying

Different methods include overhead infrared lamps or as in the *Braer* oil spill (Richie & O'Sullivan 1994) keeping in pens raised above the ground with fan heaters gently blowing warm air upwards.

- Establishing water repellency

Once the plumage has been adequately cleaned, the birds will spend much of their time on the water preening. This removes any final traces of contaminant from the feathers and access to clean water is essential otherwise the plumage becomes soiled with faecal material which results in a loss of water-repellency once more. Many of the failures of rehabilitating oiled seabirds have apparently been due to the unsuitable conditions in which the birds were maintained after they were cleaned. After 24 hours birds should be transferred to a pool for 4-7 days (RSPCA 1994).

7.1.9 Release Criteria and Post monitoring

Birds need to be fully recovered prior to release back into the wild.

Criteria for release include:

1. Birds should behave normally (feeding, swimming and diving)

- It is essential that the water repellency of plumage is restored and the bird is fully buoyant. This can be tested by placing in outdoor pools for at least 2 days before release.

2. Weights should be within 10% of the normal for that species

-Check they have recovered good muscle structure i.e. plump

3. Birds should have haematological values within normal ranges. Of particular concern is anaemia. Since many birds dive to obtain food having enough red blood cells to carry oxygen is critical.

4. Clean, non-oiled release sites should be chosen after consultation with wildlife trusts.

Suitability of release sites are based on:

- Type of habitat, weather and sea conditions, tidal state, food availability, local ecology and movement of seabird populations in order to decide suitability of a site and time of release.
- Presence of existing colony. This is a good indication. Some species are faithful to their breeding sites and the concern is that released birds will go back to the original sites. This has to be weighed up against the disadvantages of being kept in captivity for too long as they are at risk from disease and developing swollen joints. Ask the Institute of Terrestrial Ecology and the Wildfowl and Wetlands Trust for advice.

5. Birds should be inspected by the vet before release.

Post-release monitoring

Released birds should be fitted with a metal leg band and monitored to determine long term effectiveness of the rehabilitation process. Through follow-up on these animals we can better understand the effects of oil and rehabilitation on these animals and reassess the release criteria.

The RSPB will co-ordinate seabird surveys to assess immediate impact of the oil spill on seabirds present in affected areas and some evidence about the numbers of birds killed by oil and other causes can be obtained from the beached bird survey carried out.

7.1.10 Success of rehabilitation

The outlook for birds returned to the sea is not good. Previous evidence from ringing returns of oiled birds suggests that the majority of these birds die within a few weeks or months of release (Sharp 1996). Success is dependent on the condition of the oiled birds when they reach the cleaning centre. Despite this rescue of oiled seabirds is a humanitarian response and attracts a great public support and it is likely that rescue and treatment of oiled seabirds will continue so long as public attitudes remain unchanged.

Two organisations have conducted considerable research on methods for cleaning and rehabilitating oiled birds. A research unit in the Department of Zoology, University of Newcastle upon Tyne and the International Bird Rescue Centre in Berkeley, California.

Facts emerging (IMO 1980):

1. Correct treatment and bird husbandry is important. Some bird species are easier to clean and care for than others and 75% or more can be successfully treated and released, others are more difficult and survival can be as low as 25%.
2. Improper treatment by untrained volunteers contributes to stress and low bird survival. Greater success in releasing birds in a short time will be achieved if those who have knowledge and experience direct cleaning and care.
3. Adequate facilities and supplies available for bird care are important. When numbers of birds collected become excessive it is advisable to select and humanely kill birds that cannot be adequately treated. Seriously emaciated birds have a poor chance of survival and should be humanely euthanised. Caution should be taken that dehydration is not mistaken for emaciation.
4. Improperly conducted bird rescue efforts are unsuccessful and costly and few birds are released successfully. Care of oiled birds is demanding in time, manpower facilities and money. Correct care and cleaning will reduce overall costs and permit early release of birds.
5. Successful release and restoration of waterproofing to birds depends on cleaning and the agent used. Solvents are not recommended.

Conclusion:

Survival of oiled/ rehabilitated birds after release is still not fully known but reports show so far that survival is low.

7.2 Oiled Otters

There is no specific named group responsible for the rehabilitation of otters. The SSPCA is therefore responsible. Groups who can provide expert advice include the International Otter Survival Fund and the Vincent Wildlife Trust.

7.2.1 Collection

The public is advised to keep away as otters can be dangerous but if necessary they can be cornered and trapped in a box. If anyone finds an oiled otter it is best to contact the SSPCA .

7.2.2 Selection

Criteria for which animals should be captured needed to be addressed. During the *Exxon Valdez* spill some otters captured for rehabilitation were unoiled and some so lightly oiled they may have fared better if left to their own devices (Estes 1992).

7.2.3 Initial first aid

Survival rate is greatly improved when otters were treated first with fluids, antibiotics and vitamins and allowed to rest before being transported.

Liquids are vital and can be given by a stomach tube if necessary or by syringe into the mouth. Airways need to be kept clear so oil should be cleaned from these areas first.

7.2.4 Transport

Otters should be placed in a vari-kennel or plastic-wire cat-type box, depending on the size of the otter.

7.2.5 Intake

Upon arrival otters are examined by a vet. Other procedures are unknown.

7.2.6 Cleaning

Previous spills have highlighted that cleaning agents can be as damaging as crude oil or dispersants. A study carried out by Williams *et al* (1988) investigated the methods for cleaning oiled sea otter pelts and measured the changes in insulation caused by oil

contamination and subsequent cleaning because detergents promote wetting of otherwise waterproof fur and feathers. The ability to remove oil and the residual effects of the cleaning procedure on insulation of the fur are the most important factors in evaluating a cleaning technique as with proper cleaning and rinsing, the water repellency can be restored. Therefore many criteria including cleaning effectiveness, pH, commercial availability, toxicity and ease of rinsing should be considered.

Sea otters are generally sedated for the cleaning process because they would not otherwise allow it. Their core temperature should be monitored continuously to prevent overheating.

Otters are washed with fairy liquid. The detergent is gently massaged into the oiled fur and then rinsed off with fresh water.

- Problems of cleaning

Oil not coming off- if the oil is tarry, pre-treatment will often be necessary. Use a lightweight mineral oil or use a light warmed olive oil and work it into the fur. Leave on for 30 minutes then wash. Clipping is not recommended, as there will be a reduction in heat retention until the next annual moult (Smith *et al* 1995).

Coat not clean- either the animal was not cleaned thoroughly, the water is too hard or the pool is not clean (UCDavis 1997).

7.2.7 Post-cleaning

- Drying

Otters are initially hand dried with absorbent paper towels or clean, cotton towels. Once the bulk of the water has been absorbed, the fur is dried with commercial pet dryers.

- Housing

Sea otters benefit from access to salt water. Construction of pens that are blocked from the visual stress of humans walking by or working around the pools are encouraged.

A result of the washing and rinsing is depletion of natural oils from the fur and possibly the skin. The washed fur of sea otters becomes very hydrophilic and retains moisture especially next to the skin. Consequently, many of the animals have to be held in dry cages for prolonged periods until they are able to groom themselves and in order to return natural oils to the fur and quicken the return of water repellency.

7.2.8 Release criteria and post-monitoring

Release criteria

- animals should behave normally (feeding, swimming and diving)
- Weight should be within 10% of the normal for that age
- coats should be in good condition
- Pre-release veterinary examinations are needed.

Future monitoring

A survey of the coastlines of the Inner Hebrides needs to be carried out. The Vincent wildlife trust has carried out otter distribution surveys of Scotland but unfortunately not in this area.

Studies should examine:

- elements of otter food chain including fish population densities
- numbers and distribution
- Reproductive success, behaviour and fate of oil affected animals by carrying out tagging studies.
- levels of hydrocarbons in both fish and otters

7.2.9 Success of rehabilitation

Efforts to rehabilitate oiled sea otters following spills appear to be expensive and ineffective, but without attempting to rescue and rehabilitate otters they have no chance of survival. During the *Exxon Valdez* approximately 357 sea otters were captured and delivered to rehabilitation facilities. The capture effort was directed at rescuing obviously distressed animals, although it is believed that as many as 1 in 5 contaminated otters were probably never found. Of these 123 died in captivity, 37 were judged unsuitable to be returned to the wild and the remaining 197 survivors were released, 45

of them with surgically-implanted radios. Out of these, 22 were dead or missing by the next spring, indicating a low survival rate of the treated animals (Estes 1992).

7.3.Oiled seals

The group offering a rescue service is the British Divers Marine Life Rescue Service. Others with expertise are the Sealife centre (Oban), National Seal Sanctuary (Cornwall) and Orkney Seal Sanctuary.

7.3.1 Rescue and Collection

Trained personnel should carry out rescue and handling of seals. All personnel should carry a seal rescue kit (see appendix 2).

Boats will be needed to search for and rescue seals from islands and beaches inaccessible from access by road. This may be restricted by weather conditions.

Members of the public who come across oiled seals should either call the SSPCA or the Oban Sealife Centre.

If a member of the public rings in then questions need to be asked by the staff and advice given out.

<u>Initial details to collect</u>

- Ask for exact location, access, tide and sea state, level of disturbance, nearest town.
- Collect information on seal, such as coat colour, approximate body length/size (for removal if necessary), muzzle shape,
- Collect information on body condition, where are the wounds/swelling (location/size) breathing pattern/effort, any coughing/sneezing, discharges (eyes/nose-nature) lying position, level of awareness, coat wet/dry.

<u>Advice (dependent on details)</u>

- observe from a distance and keep other people and animals away
- If the seal appears sick, wounded or malnourished stay and guide rescue team to where seal is and if possible try and prevent pup from entering the sea.
- Don't attempt to handle the seal. Only handle if in imminent danger from people, dogs or the sea or if an expert has given you advice to do so. Seals bite and carry

zoonotic infections such as seal pox, brucella and salmonella and can inflict nasty bites.

Handling advice for moving (M.Steward pers. comm.)

1. Wear gloves and protective clothing
2. Handle by covering the pups head with a towel or coat, grasp the neck firmly with both hands (close to the head) free one hand and roll the pup on to its stomach, then straddle the pup to allow examination, gripping the chest and foreflippers with the knees. Avoid kneeling on the foreflippers.
3. To lift, slide one hand under the belly and support the pups body against your own with the length of your arm, gripping tightly under the pups chin and pushing the pups head against your chest to keep it restrained.

It is highly unlikely that adult seals affected by an oil spill will be captured unless they are severely distressed or emaciated. Seals are impossible to catch and would need tranquillisation, which carries an inherent risk to the seals and is not recommended (Smith *et al* 1995). Water capture is hazardous for both the rescue team and the seal as the use of tangle nets can cause the seal to drown. The use of boats however to prevent seals from entering the water has been successful.

If there is a need to capture the seals, this will involve on land capture with a variety of equipment. Seals are best handled using herding boards to guide them into transport cages to transport them to the nearest centre for assessment and treatment. If capturing a mother and pup, separate cages are recommended to prevent crushing but visual and auditory contact should be maintained. The feasibility of transporting adult seals will have to be assessed at the time but recommendations are that as far as possible adult seals should be treated on scene.

7.3.2 Assessment.

Procedures to be carried out by personnel.

- Hydration: look for dry, tacky membranes, sunken eyes.
- Skin pinch test- if a pup is dehydrated the skin will return only slowly to its normal position.
- Mucous membrane colour: normally salmon pink. If pale, it may indicate anaemia, if red, it may be due to toxaemia
- Temperature: the normal range is 36-37.2 C

7.3.3 Initial first aid

Captured seals should be assessed by a vet and first aid administered to alleviate dehydration, shock, hypothermia and to minimise stress.

Procedures

- If emaciated, lethargic or journey time is over one hour give electrolyte fluids (lectade plus) through a stomach tube prior to transport. If hypoglycaemia is suspected, glucose should be added.
- Eyes should be flushed with saline and any eye or nose discharge cleaned away with damp cotton wool.
- Wounds should be cleaned with antiseptic i.e. hibiscrub or savlon
- Faeces should be hosed off and the seal dried afterwards to avoid chilling

7.3.4 Transport

Seals tend to travel quite well but they may overheat.

- For smaller pups cages need not be any more elaborate than plastic airline kennels or even boxes or water tanks. Larger animals will require specially built cages made from aluminium, either top-opening or with vertical sliding doors and lift points for attaching a winch. Ventilation must be adequate to prevent hyperthermia and towels provided for bedding.
- Transport in a well-ventilated vehicle with the heater off and do not wrap in blankets. Spray intermittently (every 2 hours) with water on a hot day or place ice in the cage. Young or thin pups however are an exception and should be wrapped up.

- In transit temperature can be monitored manually i.e. by touching the flippers. If flippers are hot then it indicates hyperthermia, if cold, it indicates hypothermia.
- Do not transport in water (M.Steward pers. comm.)
- Take to nearest seal rehabilitation facility.

If necessary temporary facilities can be set up to hold the seals till adequate transport can be arranged.

Guidelines:

- House somewhere quiet, dimly lit, well ventilated but draft free
- Provide floor insulation i.e. rubber matting, towels blankets.
- Unweaned pups should be fed on liquidated fish such as mackerel and herring. Seals are lactose intolerant so feeding of domestic milk is not recommended.

7.3.5 Intake

- Blood tests taken on arrival will highlight any liver or kidney dysfunction
- Appetite/faecal state will highlight state of digestive tract.
- Aid free breathing with use of drugs such as Mucolytics, bisolvon or sputulosin. In severe cases a nebuliser can also be used to administer them directly via the respiratory tract (N.Gutteridge pers. comm.)
- Eyes should be flushed regularly with sterile saline and treated with drops of a non-steroidal drug such as Gentamicin if ulceration is present.
- Initial fluids are of the utmost importance for survival.

7.3.6 Cleaning

Treatment of oiled seals is the same as for most animals. Animals covered in fresh oil should be washed immediately to reduce exposure to inhaled vapours. The National seal sanctuaries protocol (N. Gutteridge pers. comm.) consists of de-oiling by scrubbing with fairy liquid followed by wound management. This involved cleaning the wound with ‘hibiscrub’ and treating with an antibiotic spray such as ‘Tetsin’. Stomach problems are frequently associated with the ingestion of oil and require treatment with a charcoal powder.

7.3.7 Post-cleaning

- 24 hour care. Every pup that comes in should receive round the clock care. At each feed and treatment session temperatures should be taken and a record of breathing effort/rate made.
- In general wounds need not be sutured as long as good hygiene can be maintained, administered antibiotics will also help.
- Most seals in the wild carry a parasite load so all animals admitted should be treated for internal parasites.

7.3.8 Release criteria and post-monitoring

Release Criteria

Two criteria need to be met (Williams *et al* 1994):

1. Seals have to exhibit behavioural maturity necessary for survival i.e.
   - swim and orient normally in the water
   - approach and consume fish independently
   - avoid contact with humans (if imprinted it reduces their chance of survival).
2. Clinically healthy and free of known diseases that could threaten the wild population

Post-monitoring

A primary concern when releasing marine mammals is the risk of introducing disease into the wild population. Thus more research into diseases and a monitoring program would be useful.

Long-term tracking is recommended. This may involve flipper tags, radio, and/or satellite telemetry. Benefits of tracking include the ability to monitor the survival rate of released animals, the possibility of resightings allowing visual reassessment of animals released, optimising knowledge of oil exposure consequences and more detailed necropsy of non survivors.

7.3.9 Success of rehabilitation

Any animal brought into captivity for rehabilitation must eventually be released.

Where seals have been cleaned for minor oil contamination there has been an extremely high success rate. Short term benefits are seen in that removal of the oiled pups from

contaminated areas reduces their exposure to volatile hydrocarbons and prevents them getting re-oiled.

Controversy surrounds the capture and cleaning of seals. Pups get separated from their mothers, visual stress and increased exposure to disease are all good reasons not to capture seals. There is still a great deal to be learned regarding effects of oil on seals and the best methods of dealing with them in order to improve rehabilitation programmes.

7.4 Oiled Cetaceans

Advice should be sought if considering rehabilitation as an option as no facilities are available in the UK apart from possibly the RSPCA Norfolk wildlife hospital and Weymouth Sea Life Centre.

Actual methods for rescuing and rehabilitating cetaceans from oil spills do not appear to have been addressed although there have been guidelines drawn up for dealing with cetaceans (Gubbay & Earll 1999a). The type of response needed will depend on the amount of oil spilled. Small spills at jetties or terminals are unlikely to affect cetaceans, whereas if it was a medium or large spill then advice on likelihood of cetaceans in the area should be sought. However, in most reports of oil slicks cetaceans appear to be indifferent and do not specifically avoid it, in fact they have been sighted feeding, surfacing and swimming through heavy concentrations with no obvious harm coming to them.

Relocation of cetaceans is prohibited under UK law and deterrents such as vessels and booms are unlikely to deter cetaceans although attaching deterrent screamers is an option. Physical presence of boats and associated noise tends to drive cetaceans into open water away from locations. Offshore rescue is not feasible and may cause further stress to the animal as well as appearing unnecessary.

The main problem may be risk of stranding in an attempt to get away from the oil. The dolphins observed aversion to oil could have some consequence in situations where they become trapped as the only route out is blocked.

7.4.1 Personnel

Identify specialists qualified in giving advice for dealing with cetaceans

BDMLR run a wildlife rescue course and have issued various protocols some of which are summarised below (Barnett at al 1998). Rescue attempts can only take place on scene. It is unfeasible to think that any cetaceans could possibly be transported to a centre unless they were really small.

7.4.2 Advice

If a member of the public comes across a stranded cetacean there are important first aid measures that can be carried out without being put at risk.

1. Initial assessment should be carried out on arrival to scene:

- Alive or dead?

Opening/closing of blowhole

Presence/absence of eye reflex

- Malnutrition

Muscle mass profile. Look for visible dipping of the muscle masses or visible neck.

- Wounds

Look for abrasions on beak, on the front of the animals head, flippers and tail fluke.

- Abnormal breathing

Normal breathing rates for small cetaceans are 2-5 breaths per minute and 1 breath per minute for larger cetaceans. Anything above 10 breaths per minute shows severe stress and respiratory disease.

- Skin condition

Look for skin wrinkling, drying and peeling.

- Temperature

Stranded cetaceans often overheat when they strand. But if malnourished and weak they may suffer from low body temperatures, particularly in cold weather.

2. BDMLR or the Environment Agency should be called immediately with details on the exact location and condition of the animal.

3. The animal should be covered with sheets or light blankets to keep the animal wet ensuring the blowhole is kept uncovered

4. A canopy should be set up over the animal to shade it from the sun.

5. Water continuously poured over the animals body will keep it cool. Care should be taken to prevent water entering the blowhole.

6. The area around the blowhole and any other exposed areas such as the beak should be smeared with lanolin, KY jelly or even ice-cream which will help keep the sun and wind from drying the skin.

7. The animal should be kept upright and if necessary a trench dug around it to keep in as much water as possible.

8. If the animal is wounded, the wound can be covered with a clean wet cloth to keep out sun and sand.

9. The public should be kept away as much as possible to minimise stress to the animal.

- Moving a live animal by its tail should NEVER be attempted as this could lead to paralysis.
- Refloating the animal without expert help should be attempted.

7.4.3 Rescue

If a cetacean beaches itself there are only 3 options:

1. Brief rehabilitation

This is only recommended if transport to a centre is not more than 2 hours away which is unlikely if around the Hebrides. Also only if the vet does not find any clinical signs of disease or wounds which require a period of treatment. Rehabilitation is only an option for small cetaceans.

2. Refloatation

The aim of this is to a). Apply treatment and then b). Return to the sea.

Criteria:

- Good body condition
- No evidence of significant disease or trauma
- Rapidly reversible dehydration

a). Treatment

- Rehydration- oral fluids such as lectade plus through a stomach tube.

- Prevention of overexposure- Provision of shade and covered in damp sheets to keep moist. Zinc oxide or KY jelly can also be applied to exposed areas. If hypothermic, shelter from the wind and cover with sheets soaked in mineral oil.
- Administer therapeutics such as antibiotics, anti-inflammatory, steroids and multivitamin injections can be administered.
- Eye and wound care. Eye should be flushed with saline and ocular lubricant applied.

b). Refloatation

For items that should be taken to a refloatation see appendix 2

procedure:

- Should be carried into waist deep water or if too heavy refloated on the tide
- The mammal should be supported with the blowhole above the water.
- The mammal should be rocked be rocked gently to alleviate muscle stiffness or circulatory impairment.
- Should be guided out seawards. It may be preferable to use boats and other equipment.

3. Euthanasia

- *Small cetaceans (<50kg).*

This should be performed by a vet with an intramuscular injection of Large Animal Immobilon. Use of lances, explosives, shotguns or a .22 rifle should not be used as these have proven to fail.

- *Larger cetaceans*

Despite attempts at injecting Immobilon into the tongue, lips and lower jaw the recommendation is that such animals should be left to die naturally (Barnett *et al* 1998).

Criteria for euthanasia:

-Emaciation

-Suffering from severe disease or trauma

- If a dependent calf as no facilities exist for social development in captivity.

The human factor must be considered when oiled animals are involved. In heavily populated areas, it may not be possible to leave oiled animals. The resultant public outcry means that a well-organised response that involves minimal stress to the animal

should be carried out. If there are individual animals or species that are better left untouched it is critical that the public be informed of the rationale behind the decision so that their support is enlisted.

7.4.4 Long term monitoring

As the animal may restrand photograph the dorsal fin and place a loop of degradable ribbon around the stock of the tail. Long term success rates can be determined by satellite tracking.

8. Other considerations for contingency planning.

8.1 Carcass collection and disposal

Disposal is defined as the process of treating or storing a waste material in a way to render it harmless to the environment or convert it into a substance that will have commercial value.

Any contingency plan should contain details on:

1. *Identifying personnel for waste handling and disposal*

Responsibility for the ultimate disposal remains with local waste disposal authorities i.e. Argyll and Bute Council.

Disposal is dependent upon size.

- Small animals <5.5m- veterinary services
- Larger animals- local council environmental health officer will need to be contacted.

2. *potential disposal options which would be available for dealing with different amounts and types of animal.*

Following a major spill it is unlikely that any single technique will be capable of dealing with the quantities to be handled. Such plans should be local in nature since the methods adopted will be largely dependent on the availability of suitable facilities and disposal sites.

There are two techniques which may be suitable for carcass disposal:

1. Landfill disposal- landfill is a possible method. Nevertheless it is regarded as a poor form of long term storage. If the tip is well compacted the oil will hardly be degraded and therefore waste will compromise a potential source of pollution for many decades especially risky if there is a water source nearby. On correspondence with A. Taylor (Argyll & Bute Council) I was informed that 'Disposal is a problem. Sea birds with exceptional oiling will largely be a mass of oil and as such cannot be disposed of to a licensed waste disposal site, as the licence does not apply to oil/oiled waste' In these circumstances, birds would be treated as special waste and would require to be disposed of in an incinerator. The closest incinerators available are in Dundee. SEPA would provide advice on these.

2**.** Incineration- on-site incineration is complicated and it is a laborious process to put mobile incinerators into position. Other problems include the limited capacity of such equipment or the feasibility of transporting contaminated material to a suitable incineration plant.

3. Investigate the availability of temporary storage capacity and select suitable sites for excavating pits since all disposal routes are likely to have limited capacities. Provided sufficient temporary storage can be found the problem of disposal can be approached in stages.

The oil and oiled waste needs to be disposed of in an environmentally sensitive way and the disposal solution(s) will vary according to the site (the coastal areas of Mull are mostly cliffs or hard rock so temporary storage will be a problem).

The procedure is to dig a hole and line with plastic, preferably next to a road for easy access. The problem with Mull is that there is a lot of rain so the site will quickly fill up with water and flood over the land.

4. details of disposal methods and temporary storage sites should be annexed to the operational plan

The council has no plans for the storage or disposal of oil relative to any specific site in Argyll and Bute (A. Taylor pers. comm.).

8.2 Logistics

- Logistic support

Arrangements should be made for providing food, clothing, shelter and medical support to clean up crews

- Funding

The source of funding needs to be identified:

- Ultimately the ‘polluter pays’ for clean up. Till this can be determined, the Marine counter-pollution branch of the Maritime Coastguard Agency (MCA) is responsible.
- Charitable appeals. Donations are likely to appear so a wildlife fund should be set up as soon as possible.

- Volunteers

Guidelines should specify potential volunteer activities. Most wildlife experts recommend that only experienced personnel should be used in the clean up, however there are important tasks out there that unskilled volunteers could do and with this help, more relevant personnel can put their skills to best use leading to a more effective response.

Volunteers should be screened on arrival to discover experience and abilities and divided into skilled and unskilled. The skilled should be given a set of protective clothing and a set of guidelines detailing occupational safety and health practices.

Unskilled volunteers still have an important part to play. The importance of tasks such as administration tasks i.e. answering phones, running errands, record keeping, organising supplies, collection and transport of dead and live wildlife, and other rehabilitation tasks such as feeding, preparing foods and cleaning pens, should not be underestimated. These processes are essential to ensure that the rescue and rehabilitation effort succeeds. Oil spills generate an immense amount of good will and help will come from all over the world in a variety of forms. Inevitably people will travel to these islands on their own initiative. However the distance and the cost of travel may provide a control on the number of people turning up. Narrowness of the roads will limit transport vehicles and a plan should maybe contemplate chartering coaches to transport workers back and forth.

The response plan will not be able to incorporate all the possible help that could be offered and in practice, improvisation is an inevitable consequence.

After the oil spill it is recommended that in order to keep goodwill amongst volunteers so that a potential reservoir of volunteer can be set up, an advert of thanks should be put in the local paper, a letter of appreciation should be sent to all who loaned/donated equipment and services and every voluntary participant should be presented with a small token such as a T-shirt.

- Media

Advice for dealing with media should be addressed.

Guidelines for early stage (Algar 1999):

1. Apologise for the accident, give out as much positive news as possible on the means being taken to mitigate the damage to people and the environment and praise the emergency services where appropriate.
2. Refrain from speculating on the cause of the accident and avoid blaming others. Condition of any injured personnel should be known, as should the impact of the cargo on the environment. Ignorance can easily be equated with callousness.

At the *Braer* spill, the amount of media interest was underestimated. Security will be needed and the police should be asked to help. The Inner Hebrides is well known for its wildlife so the media will seek information about presence and risk. Therefore marine mammal and bird specialists should be appointed to liase with the press officer to give knowledgeable briefings.

At media briefings a panel with a range of expertise i.e. those with knowledge of animal biology, conservation issues, animal welfare and local conditions should field questions. Volunteers should be asked to refrain from speaking to the media apart from describing simply what they are doing as different reports will only confuse the issue and cause misunderstandings and false reports.

- Communications

Companies must plan to deal with thousands of telephone calls and write informative press releases to be announced. The best arrangement for dealing with telephone calls would be to set up a switchboard number with six separate lines, a second number with restricted access, a dedicated fax line and an email system would be useful. This will allow calls to be screened and prevent key personnel being distracted from more important tasks. Provision should be made for hand held radios to be issued to all participants in beach searches allocate separate frequencies being allocated for different operations

All information on clean up and logistic support should be channelled through the communications centre:

- announcements on BBC radio Scotland and local TV stations can be made for volunteers
- media information, offers of accommodation and voluntary assistance can be processed.
- where clean up operations are conducted over extended distances portable communications centres should be located close to the scene of each operation

- Documentation of actions

A documentation manager should be appointed to maintain a complete and accurate record of all events that occur and are supported with as much quantitative data as possible, pictures, videos, text, interviews, notes etc.

It is very important to record the use of manpower, equipment, materials and expenditure.

- Termination

Guidelines should specify at what stage the clean up should be terminated?

- It is difficult to give precise guidance on this in a contingency plan as it should be terminated when becomes ineffective

-The decision needs to be made by liaison with all interested parties regarding the conduct of the operation and the level of clean up appropriate to each location

Factors to determine it

-Importance given to the area

-Rate at which natural cleansing is expected to take place

-Cost as effort required to collect carcasses will rise as the amount arriving on the shore decreases

Discussion

The initial aims of this project were to actually write an operational plan to rescue and recuperate affected marine wildlife. It became clear that this task was well beyond the scope of an MSc dissertation and would take more time than was available to complete it properly. Extensive travel and liasing with interested parties was not feasible with the time and financial constraints of the project. Guidelines have been drawn up using information gathered from a wide range of sources, in the hope that they may help promote and aid the construction of an operational plan for wildlife rescue to be included in the National Contingency Plan.

The effectiveness of rescue and rehabilitation operations following oil spills is unclear, because clean up may be more detrimental than the actual oil. The cleaning of birds is generally carried out for the welfare of the individual birds rather than for conservation reasons and studies have cast doubt on whether cleaning is in some birds best interest suggesting that a large proportion die soon after release (Sharp, 1996). This view has not gained universal acceptance and it is likely that there will continue to be a strong public demand for bird cleaning following future spills. Clean up of marine mammals can cause unnecessary disturbance. Efforts carried out by well meaning individuals with no expertise in this area can lead to the stampeding of previously unoiled seals into oiled water leading to the trampling/abandonment of young. There have been reports of rescuers chasing birds in speed boats with nets and during the *Braer* incident for example out of the 6 otters that died, 3 of them were run over by motor vehicles, presumably by the rescuers.

This project has highlighted the following important points:

- It is practically impossible to form more than a rough estimate of bird losses caused by oil spills. This is because many processes affect the proportion of oiled birds found. Recovery of birds is dependent on conditions such as the distribution and density of birds at sea, distance of the spill from shore, wind and ocean currents, number of people involved in the recovery of birds and accessibility of the shore, density of scavengers on the beaches, sinking of carcasses at sea and burying of

carcasses on beaches (Ford *et al.* 1987). Oiled seabirds found dead or alive therefore represent only a fraction of the overall mortality and the notion is that mean estimate is 4-5 times the body count (Burger, 1993), so research on the percentage of carcasses arriving on shore is of no value except for at the site of the spill.

- Effects of oil on marine wildlife remain largely speculative. It is impossible to relate laboratory studies of sublethal effects of oil on specific organisms to mortality from oil in the environment. Mortality is only significant if it results in a significant decrease in the population, birds with a low replacement rate such as auks cannot sustain repeated losses from oil and population decline will be the result. Most oil spills affect birds when they are at sea rather than in their colonies and seabirds spend much of their time at sea, however all come ashore to breed and generally go to favourite breeding sites. Dunnet (1982) noted that re- growth of colonies after oil spills appeared to be rapid. This is believed to be as a result of the population of young, non-breeding adults, that are out at sea, now having space to come on shore. They therefore provide a reservoir from which depleted breeding colonies can be replenished if necessary. Birds are the obvious casualties of oil pollution but do not seem to have suffered devastating effects at population level. The threat to cetaceans is uncertain but they appear to be able to swim away. Seals do not seem to be heavily affected by oil pollution either. Otters are potentially heavily affected but again so little research has been done on this and actual distribution in the Inner Hebrides is largely unknown that we cannot predict if an oil spill will have a devastating effect on them. Future monitoring is therefore needed but the problem with work of this kind is that it will have to wait till another oil spill occurs for it to happen. Initial effects of the oil spill can be assessed in field conditions as opposed to laboratory experiments and thereby give a more accurate indication. Monitoring should be seen as an important opportunity to extend knowledge at an oil spill and guidelines should be written for undertaking initial impact and long term monitoring work so that extensive monitoring can be undertaken at the earliest possible moment.

- It is important to be able to detail the exact location of all the breeding colonies and feeding areas and coastal access to these sites. In order to address the effects of oil pollution, you also need to take into account natural mortalities so as to determine whether or not the observed mortality is substantial. Such an approach requires detailed information on the distribution and numbers of seabirds at breeding colonies and at sea in their pre-breeding years in association with their breeding activities and also in their wintering areas. Data that just doesn't exist. At present the information is fairly speculative and seems to be based on the assumption that if an oil spill is going to happen, it is going to be a large one, the information highlights that there is wildlife in a stretch of 3km of coastline but that is as detailed as it gets. If the oil spill was small, such as a boat grounding itself off some rocks or ballast tank discharge, it would probably only affect a small stretch of coastline. The level of response to this will be different, in fact I doubt much response will be initiated at all but with the Inner Hebrides being of uttermost importance for wildlife, that shoreline could have an especially important breeding colony of seals on it, yet the data and maps we have at present does not have this in depth information marked on it. In the event of an incident there would be a need to carry out emergency survey work in areas which may be affected, to fill in gaps in available baseline data. Data on numbers alone cannot show rates of turnover in colonies and the loss of experienced individuals and their replacement by new, young recruits. We also need data on marked individuals, reproductive success and diet to relate changes in colony size to oil pollution. Many of the birds cleaned should be ringed before release under the national ringing scheme administered by the BTO which will provide information on the survival of these birds in the wild as they are re-captured or found dead. At the moment the database of ringed birds is relatively small and more information is needed. For most species rehabilitation rates are not known and for less common species there is a strong conservation argument to find the best methods and to try to rehabilitate as many as possible.

- Another point requiring clarification is the designation of special sites for conservation. Vast areas of the Inner Hebrides have been designated Special Sites of Scientific Interest (SSSI's) and with Natura 2000, areas have been selected as Special Areas of Conservation (SAC's) and Special Protection Areas (SPA's). Many

of these sites will have limited access for vehicles and no mention seems to be made in any plans of how to safeguard these sites from the clean up operation or to assess the risks from the clean up, to species or habitats for which the sites were designated.

- Effective contingency planning and earmarking of people and equipment would create an effective animal welfare response. Mistakes that have been made in previous spills, appear to have been made again and again in consecutive spills. The most prominent reason being lack of preparation. There is more preparation being done for dealing with wildlife than was originally expected by the author. The SSPCA and RSPB have drawn up their own oil spill contingency plans and according to Richie & O'Sullivan (1994). The Institute for Terrestrial Ecology (ITE) have been working on a model animal welfare oil spill contingency plan for general use. It is not certain whether this has been completed or not. All local authorities have a legal responsibility to draw up plans for their area with lists of trained personnel and equipment. Another fact that has been brought to light is that as a result of previous oil spills there are an increased number of people experienced in the treatment of oiled seabirds. It would be advantageous to establish wildlife training programmes for potential volunteers to ensure trained personnel could be recruited in the event of an emergency. It has been mentioned before that a register should be kept of experienced volunteers and their areas of expertise so they can be asked to help in any future spills. British Divers Marine Life Rescue have been carrying out training programmes for marine mammal rescue in Western Scotland and have a list of people whom attended.

- Shortfalls of this project are that it has only dealt with the Isle of Mull. Obviously there are so many other islands to be taken into consideration in the Inner Hebrides. This however proved to be beyond the scope of an Msc project, although it is hoped that the guidelines for setting up a wildlife response plan will apply to all areas. Visits need to be made to all of the major groups and rehabilitation centres involved and personnel interviewed. These interviews really need to be in person and the difficulty in collating the information required for this plan was beyond the time and financial constraints of the author and those of other people. Drawing up a more

concise list of facilities for wildlife rescue would be useful but substantial travel would be involved. The bulk of this project being over the summer period many people were either inundated with requests or were on holiday and most information took weeks to get back if at all. With more time it would be useful to would be to set up a forum (as mentioned in section 2.2) to discuss strategies with groups such as Scottish Natural Heritage, the local council, the Royal Society for the Protection of Birds, the National Trust for Scotland and local groups such as The Hebridean Whale and Dolphin Trust and the Islay and Jura Seal Action Group. Other groups who may not have a part to play in establishing priorities for protection but will have a role to play when there is an oil spill may be interested in attending. These include the emergency services i.e. local coastguard and police, local vets, the Scottish Society for the Prevention of Cruelty to Animals (SSPCA), British Divers Marine Life Rescue and the Sealife centre. Other bodies who may be interested are the Whale and Dolphin Conservation Society, the Sea Mammal Research Unit, the Marine Animal Rescue Coalition, the International Otter Survival Fund, the Seawatch Foundation and the wildlife division of the Department of the Environment, Transport and Regions. Procedures to follow when there is an oil spill and techniques for dealing with oiled wildlife can then be discussed.

- It would be naïve to claim that as a result of this project it will be possible to successfully rescue and recuperate wildlife in the Inner Hebrides. Other factors need to be taken into account, new and better methods will always be discovered and mistakes will always be made. The main problem behind successful rehabilitation is the failure to restore water repellent properties to fur and feathers. Previously it has been found that cleaning oiled birds for example, makes the plumage lose its water repellent properties and thus birds placed back on the water, quickly become waterlogged, losing their buoyancy and thermal insulation. This condition persists until the birds replace their plumage at the next moult. Rehabilitation can only succeed if a treatment is devised that restores the water repellent properties of the feathers after the contaminating oil has been removed. A method that does not remove water repellency would be an added advantage as it has been found that while the birds are being treated they have a tendency to develop respiratory infections such as aspergillosis, infective arthritis and enteritis (Clark, *et al* 1997).

The longer the birds remain under treatment, the less chance of survival and also the longer their period in captivity, the less chance of successful reintroduction into the wild, highlighting the need to find a quicker way of establishing water repellency. Recent research has been carried out by ELF to attempt to develop a type of bird 'washing machine'. This French-made machine can clean a bird in seven minutes as opposed to two hours by hand. Tests carried out on this machine showed that the birds recovered their metabolic rate one day after cleaning and their thermal insulation four days later. There is lack of knowledge on how much stress it puts the birds under and also it will only clean birds as big as guillemots and razorbills, anything larger has to be cleaned by hand. More excitingly therefore is the research being carried out by Copley (1999) investigating the use of magnets to help wildlife recover from oil slicks. Birds may soon be cleaned using iron powder and magnets. Unlike detergents, this method will not destroy the waterproof properties of feathers. It works because oil sticks to iron powder in preference to birds feathers, combing the feathers with a magnet then removes both the oil and the iron. This method is quicker than surfactant treatment, which will allow more to be treated per hour. It does not involve scubbing, rinsing and drying the feathers and so requires less handling which minimises stress for the birds. The only disadvantage is that severely oiled birds coated with a dried tar-like residue may prove resistant to this treatment. More research is needed into this.

To conclude therefore, forming more than a rough estimate of the losses caused by oil spills would be useful in order to assess effects at population level. Effects of oil remain largely speculative but it is essential to highlight the effects in order to formulate an appropriate strategy for protection of the resources. More data also needs to be collected to detail where all the breeding and feeding areas are before protected areas for wildlife can be determined. Protected areas cannot be determined until other factors such as important shoreline types have been established. The Inner Hebrides contains important stretches of saltmarsh, *Zostera,* maerl and *Modiolus* beds. The importance of these will probably have more bearing on whether the area will be a priority for protection than the fact there is a seabird or seal colony there. Other wildlife needs to be taken into account such terrestrial animals e.g. foxes which may get covered with oil when foraging on coastlines. And finally a forum needs to be set up to discuss with all

relevant groups the strategy to be followed for wildlife rescue and rehabilitation in the event of an oil spill in the Inner Hebrides.

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Appendices

Appendix 1. List of Sites of Scientific Interest

Appendix 2. Roles and responsibilities. List of contacts and rescue kits.

Appendix 1

From 1.3 Coastal Sites of SSSI selected for their conservation designation partly on the basis of their bryophyte and lichen interest, many contain rare and scarce species and qualify for SSSI status on the basis of their lower plant fauna alone.

Site	**Grid ref**	**Protected status**
Sound of mull cliffs, Mull	Nm5351	SSSI
Ardura-Auchnacraig, Mull	Nm7029	SSSI
South Mull coast	Nm5321	SSSI
Ardalanish Bay, Mull	Nm3618	SSSI
Coladoir Bog, Mull	Nm5530	SSSI
Ardmeanach, Mull	Nm4429	SSSI
Ardtun leaf beds	Nm3724	SSSI
Gribun shore and crags, Mull	Nm4535	SSSI/ SAC
Ben More-Scarisdale, Mull	Nm5237	SSSI
Lagganulva Wood, Mull	Nm4542	SSSI
Staffa	Nm 3235	SSSI
Treshnish Isles	Nm2741	SSSI /SAC
Calgary dunes, Mull	Nm3751	SSSI

From JNCC protected sites database (JNCC 1997).

Appendix 2

From 3.2 *roles and responsibilities*

Roles of personnel and contact list

(please note: this list was drawn up by me and may not be fully concise)

- Despite repeatedly contacting most of the groups on this list I got very little feedback on what people saw as being their area of responsibility or expertise in the event of an oil spill. Therefore the following is mostly my own opinion on what part they should play, whether actual hands on or advisory. These roles naturally will depend on the situations at the time and who is available.

- Government groups involved

HM government accepts responsibility for dealing with major spillages of oil which threaten UK interests.

Name	**address**	**role**
Marine Coastguard Agency **-counter pollution branch**	Spring place 105, Commercial Road, Southampton SO15 1EG tel: 01703 329 100 fax 01703 329 404 24 hour information service 0870 6006505	- initiation and co-ordination of civil maritime search and rescue -mobilisation, organisation and tasking of adequate resources to respond. -support local authorities who are responsible for on-shore pollution. -advise on contingency plans, provide training, emergency operations room, -contains details on stocks of dispersants, remote sensing surveillance equipment. Holds government stockpiles of shoreline clean-up equipment.
Local Coastguard	See later	- receive initial report of an oil spill -responsible for contacting counter-pollution branch. - lend expertise in helping clean up workers gain access to difficult shoreline locations
Police	See later	-Act as a security role -Consulted to restrict access to beaches where oiled seabirds are coming ashore
Fire Service	See later	-assess whether oil on shore is flammable -provide equipment i.e. hoses to keep stranded mammals cool.
Department of the Environment, transport and regions (wildlife division) **(DETR)**	Local- 01703 329 100 Main HQ Eland House, Bressenden Place London SW1E 5DU	-coordinating role in pollution incidents -environment research programme -analysis of saltwater samples

	0171 890 3000	
Department of trade and industry (DTI)		-reviews contingency plans -oil spill response techniques and policies -laboratory undertakes analysis of oil pollution samples
Joint Nature Conservation Committee	11, Dunnet House 7, Thistle Place Aberdeen AB10 1UZ 01224 655702	-responsible for research and advice on Nature conservation
JNCC seabirds at sea team	17, Rubislaw Terrace Aberdeen Tel: 01224 642 347 Fax: 01224 643 347	- research into seabird distribution at sea. -gives advice on potential impacts of oil pollution at sea on birds -have a seabird colony register
Scottish office Agriculture, environment and fisheries department (SOAEFD)	Pentland house 47, Robbs Loan Edinburgh 0131 244 0213	-provide advice and support for action to be taken in locations where fish and shellfish are threatened. -approval for use of dispersants -assess general quality of the marine environment and fish and shellfish stocks and fisheries sensitivities -monitor contaminant levels
SEPA **Mrs P. Henton (director of environmental strategy)** **Mr Fraser** **Protection services** **01397 707002**	East region Clearwater House Heriot-watt research park Avenue North Edinburgh 0131 449 7296.	- responsible for control of pollution of land based spills of oil. - advise on possible pollution of the waterways.
Argyll and Bute Council **-local authority** **Alexander Taylor (head of public protection).**	Kilmory Lochgilphead Argyll PA31 8RT tel: 01546 604 132 fax: 01546 603 934 sandy.taylor@argyll-bute.gov.uk	-responsible for dealing with the pollution of the shoreline -set up a joint response centre. -gives advice on dumping/storage areas. -advice on coastal access points. -has a list of oil pollution contacts, waste disposal contractors and equipment suppliers.
Department of public protection and health. **-Environmental health department**	01631 564 211	-Deploy cleaning staff and equipment -collect samples of pollutant -responsible for identification and disposal of hazardous substances -dead seal disposal
SNH **-John Baxter** **SNH Oban** **-Liz McTeague**	Edinburgh is the focal point for expertise. 12, Hope Terrace Edinburgh EH9 2AS Tel 0131 447 4784 Fax 0131 446 2277 Glencruitton Road, Tel 01631 567 228 Fax 01631 567 229	-not directly involved in rescue and treatment -advisory capacity to RSPCA and government -advise concerning conservation of nature, landscape and coastal amenities -co-ordinate the scientific response i.e. commission research on seabirds - Advise local authorities on biologically sensitive areas

SNH Fort William - **Greig Mudge** **SNH Rhum** **- Elsie Ashworth** **SNH Inverness** **-Ben Leyshon**	01397 704 716 01687 462 026 01349 865 333	especially SSSI and ways to minimise impacts,on wildlife. -Arrange for the collection of dead seabirds -knowledge of bird populations and protocols for release. - have maps of areas showing habitats and oil sensitivity -establish leave alone sites where oil will be left untreated

- **Advisory groups**

name	**Address**	**role**
RSPB- **Edinburgh-** **Mull-** Richard Evans **Tiree-** Alan Leitch **Coll –** Charlie Self **Islay-** Julie **Small isles-** Alison MacLennan	 01680 812 430 07808 067 254 01879 220 748 01879 230301 01496 850505 01471 822 882	-not directly involved with bird rescue and cleaning -information on the distribution of birds and where habitats are concentrated -carry's out beached bird surveys -important bird feeding, resting and breeding areas
Institute of Terrestrial Ecology (part of NERC)	Morus Wood Abbots Ripton Huntingdon Cambridgeshire PE17 2Ls	-contain a model animal welfare oil spill contingency plan. -provide advice on release areas for birds
Wildfowl and Wetlands Trust	Slimbridge Gloucester GL2 7BT Tel: 01453 890 333 01453 890 827	-provide advice on release areas for birds -monitor bird numbers -database on numbers and distribution of wildfowl.
International Fund Animal Welfare -Dr Peter Evans -Dr Jonathon Gordon	Warren Court Park Road Crowborough East sussex TN6 2GA Tel: 01892 663374	- knowledge of porpoises
Seawatch Foundation Dr Peter Evans	C/o Edward Grey Institute Dept Zoology University of oxford. Oxford OX1 3PS Tel 01865 727 984	-have information on cetacean sightings.
Marine Conservation Society	9, Gloucester Road Ross-on-Wye Herefordshire Tel 01989 566017 Fax 01989 567 815	- information on effects of oil
Scottish Wildlife Trust Alistair Somerville	Cramond House Cramond Glebe road Edinburgh EH4 6NS Tel: 0131 312 7765	-information on distribution of wildlife
National Trust for Scotland Abby Patterson	Loch Voil House Dunuaran rd Oban PA34 4NE Tel 01631 570000	-information on shorelines
MAFF	Room 149, Nobel House 17, Smith Square London	-give advice/approve use of dispersants -protection of fisheries- give public protection prohibitions

	SW1P 3JR Tel: 0171 238 5879.	-advisory scientific role to government -set up a team to advise on fisheries and to assess the scale of the spill and species most at risk.
World wide Fund for Nature	Panda house Weyside park Catteshall Lane Godalming Surrey GU7 1XR Tel 01483 426 444 Fax 01483 26 409	-contribute to study of environmental effects --advice on minimising damage to marine life. -works with governments, industry, scientists, biologists
British Trust for Ornithology	The Nunnery Thetford Borfolk PP24 2PU Tel: 01842 750050 Fax 01842 750030	-counts of wintering flocks -collect information on survival rates of rehabilitated birds
Dunstaffnage Marine Laboratory -Mike Burrows	DML Oban	- provide information on marine priority habitats and important species in the region

- **Oil authorities and contractors**

Name	**Address**	**role**
International Tankers Owners Pollution Federation Ltd. (ITOPF)	Staple Hall Stonehouse Court 87-90 Houndsditch London EC3A 7AX tel 0171 621 1255 fax: 0171 621 1783	-has a compensation fund -provides technical assistance on scene. -have details on private companies around the world that offers equipment and services -have information on liability and compensation for oil spills
United Kingdom Offshore operators association (UKOOA)	9, Albyn Terrace Aberdeen AB10 1YP Tel: 01224 626 652 Fax 01224 626 503	-have stocks of dispersants and other counter pollution equipment
British Oil Spill Control Association		-represents specialist British companies who supply pollution control equipment
UK Petroleum Industry Association		-acts as a link to transfer information between the oil industry and authorities -Maintain information on local ability to respond to an oil spill by documentation of resources of members, contractors etc.
Oil Spill Response Ltd.	Lower William Street Southampton SO14 5QE Tel 01703 331551	-non profit organisation -funded by 24 of the largest oil companies -provide a response service - have major oil spill equipment depot at Southampton
Alba International	Leading light building 142, sinclair road Torry Aberdeen Tel: 01224 878 188 (24 hr) fax : 01224 879 781	International oil spill consultants & service contractors- equipment supply maintenance and spill scene support
Briggs Marine and Environmental services	Leading light building 142, sinclair road Torry	Owner MV forth explorer. Spill control vessel, clean up specialists and training services.

	Aberdeen Tel:01224 898666 Fax:01224 896 950	
Texaco		Only company to have expertise in wildlife rehabilitation

- **Groups Involved in Rescue**

Name	**address**	**role**
SSPCA Dorien Graham-press officer Bert Douglas(Oban)	Braehead mains 603, Queensferry Road Edinburgh EH4 6EA O131 339 0222 Royal Fern Dunollie Road Oban Tel 01631 562256	- Co-ordinating rescue and treatment of live birds. -Set up an emergency holding and cleaning centre for preliminary first aid treatment before being transferred to RSPCA wildlife hospitals. - Recruit and train volunteers. - should keep a register of volunteers and own staff who have experience
British Divers Marine Life Rescue Mark Stevens (director) Scottish co-ordinator Alaistair Jack -tel 01847 851 741	39, Ingram road Gilingham Kent ME7 1SB. Tel: 01634 281 680 Briarbank Scarf skerry Thurso KW14 8xN	Registered charity specialising in the rescue of marine wildlife -provide boats and expertise for capture of oiled wildlife -Have a list of people trained in marine mammal rescue in this area. -Have information on nearest facilities and their capacity for rescue and rehabilitation
Bob Reid Scottish stranding co-ordinator	SAC veterinary services Drummondhill Stratherrick road, Inverness IV2 4JZ Tel 01463 243030 Fax 01463 711103 Email ; wildlifeunit@ed.sac.ac.uk	Pathology of dead cetaceans -also helps with rescue

- **Wildlife centres/ wildlife groups**

Name	**address**	**role/ facilities**
SSPCA – seabirds	MiddleBank Animal Welfare Centre Masterton Road Inverkeithing Nr Dunfermline KY11 5QN tel 01383 412 520 (8.30-5) In emergency call 077775 695 467	- 3 outside cages - capacity for at least 280 birds
SSPCA- Shetlands	01595 840 321	- specialised bird cleaning unit
RSPCA wildlife Hospital,	West Hatch, Taunton, Somerset. Tel 01823 480 156.	

Vincent Wildlife Trust **Jim and Rosemary Green**	Otter Rehabilitation Centre Barjarg Girvan Ayrshire Tel 01465 821 225	-knowledge on distribution of Otters in Scotland
Sea Life Centre **Mark Steward**	Barcladine Oban Argyll PA37 1SE Tel: 01631 720 386 Fax 01631 720 529	-centre to 'rear and release' scheme for seal pups -seal pup nursery and hospital -contain information on rescue and rehabilitation of seals -2 isolation tanks -4 pens 1 adult, 2 pup cages for transport
SSPCA seal Unit **-Sandra Bonner**	MiddleBank Animal Welfare Centre Masterton Road Inverkeithing Nr Dunfermline KY11 5QN tel 01383 412 520 (8.30-5) In emergency call 077775 695 467	purpose built seal pool 2 pre-release pools 10 enclosures in seal cleaning unit
National Seal Sanctuary **Miles Wheller (operations manager)**	Gweek Near Helston Cornwall TR12 6uG tel: 01326 221 361 Fax 01326 221 210 email seals@sealsanctuary.co.uk	hospital with isolation unit Isolation unit- 2 dry pens and 1 floodable pool pen Main hospital- 4 pens= can be used either dry/flooded. A facility to house 9 pups at any one time.
Norfolk RSPCA Hospital **Ian Robinson** **Alison Hutchison**	Station Road East Winch Kings Lynn Norfolk PE23 1NR Tel: 01553 842 336. Fax 01553 842 543	
Cheshire RSPCA hospital	Stapeley Grange Cheshire Tel: 01270 610347.	-temporarily hold seals

- **Research Organisations**

Name	**address**	**role/advice**
The zoological society of London-Institute of Zoology contact: Thijs Kuiken	Regents Park, London, NW1 4RY tel:0171 722 333 fax: 0171 483 4436	post-mortems studying causes of death of marine mammals- report carcasses to them
University of Liverpool		post-mortems
International Zoo Veterinary Group		post-mortems
Veterinary Investigation Centre	Inverness	
Natural History museum Department of Zoology contact: Martin Sheldrick	Cromwell Road London SW7 5BD	study into causes of death of marine mammals- report carcasses to them

	0171 938 8861	
Natural Environmental Research Council Dr Sheila Anderson	Polaris House North star avenue Swindon England Tel: 01793 411 500	
Sea Mammal Research Unit (SMRU) Dr Ailsa Hall Dr Paul Thompson Dr Callun Duck		- study into causes of death of marine mammals- report carcasses to them -assess health of seals in the wild and gain idea of likely number and length of time over which casualties might be found -report on seal numbers -information on first aid for stranded mammals
Marine Animal Research Council (MARC) Mark Simmonds (Chairman)-also	01225 334511	-provide information - Bring together agencies and rescue groups to pool their experience and come up with new methods of rescuing marine wildlife. -provide equipment
Oiled Bird rehabilitation Research group	Department of Zoology University of Newcastle-upon-Tyne	-advisory committee on oil pollution -have correct methods for cleaning and caring for oiled birds
Applied ornithology unit Pat Monahan	Zoology department Glasgow university 0141 339 8855	-Looks at effects on eggs, feeding and behaviour.

- **Local groups/individuals**

Name	**address**	**role**
Hebridean Whale and Dolphin trust Dr Chris Parsons	28, Main Street Tobermory Isle of Mull 01688 302 620	-study, protect and educate the public about Scotland's whales and dolphins -data collection- bird/seal counts
Islay and Jura Seal Action Group George Middleton	Kildalton Port Ellon Islay Argyll PA42 7EF Tel: 01496 302 411	-local knowledge of seals
Sea Life Surveys Brennan Fairbanks	Breidwood Beadoun Tobermory Isle of Mull Argyll PA75 6QA tel: 01688 302 787	local wildlife knowledge provide a boat
Rare breeding Birds Panel Dr Malcolm Ogilvie	Islay 01496 850 218	-breeding/potential breeding records
Landrover wildlife expeditions David Woodhouse- islands leading ornithologist.	Ulva House Hotel Tobermory Tel/fax 01688 302 044	-local knowledge of wildlife areas

Wildlife & Birdwatch Safaris Richard Atkinson	Arla Beag Aros Isle of Mull Tel 01680 300 441	-local knowledge of areas for otters and seals
Turus Mara --cruise ship	01688 400242/297 mobile:0831 638179	-local knowledge
Gordon Grant Marine	Achavaich Isle of Iona 01681 700 338	-knowledge of areas for seals, dolphins, porpoises and whales
Inter-island Cruises	Ardrioch Farm Guest House Dervaig Isle of Mull Tel/fax 01688 400264	- local knowledge of wildlife
Chalice Mark Henrys	0411 700670	-local knowledge of distribution of marine mammals

- **Local useful contacts**

Women's Institute		supply food and hot drinks for clean up workers
Womans Royal Volunteer Service Brenda McGilliard	Dervaig 01688 400 338	supply food and hot drinks for clean up workers
Red Cross -Miss Henderson		- have 2 disaster bags - have a list of members to notify
Veterinary practices Dr Gerry Wilson (Mull) Dr Max Bonniewell (Oban)	 01680 300 319 Predail Street, Oban 01631 562 876	 -Has no facilities. Did not appear interested in oil spill wildlife rescue. -Limited facilities. Is very interested in wildlife rescue.

Availability of boats

Name	location	contact
Alternative boat hire	Iona	01681 700537
Brian Swinbanks sea angling	Tobermory	01688 302458
Charlie Laverty	Tobermory	01688 302 048
Craignure Charters	Craignure	01680 812332
Gordon Grant Tours and Charter	Iona	01681 700338
Inter Island Cruises	Dervaig	01688 400264
Northern Light	Lochbuie	01680 814 260
Sea life surveys	Dervaig	01688 400223
Swift charters	Tobermory	01688 302390
Staffa trips	Iona	01681 700358
Turus mara	Dervaig	01688 400242
Voltair charter	Dervaig	01688 400380

Haulage and carriers

Name	Location	contact
ACE distribution	Fionnphort	01681 700276
Argyll Carriers	Connel, Oban	01631 710363
A Stevenson	Braehead, Oban	01631 566665
Derek Wilson Carrier Services	Oban	01631 562 655
G Harper	Tobermory	01688 302263
J.A MacDonald	Tobermory	01688 302 414

M.B.S Haulage	Craignure	01680 812 385
Michael Williams	Oban	01631 565 765
Torosay Sandpit Ltd	Torosay	01680 812475

Plant Hire

Name	location	contact
Charlie Hogg	Tobermory	01688 302173
Don Construction	Tobermory	01688 302133
Mike Roeleveld	Tobermory	01688 302362
Torosay Sandpit Ltd	Torosay	01680 812475

Transport
Car and minibus hire

name	location	contact
Bayview garage	Craignure	01680 812 444 01680 812 445 0375 256 267
Mackays garage	Tobermory	01688 302 103 01688 302304

Bus services

Name	location	contact
Bowmans Bus Service	Craignure	01680 812 313
Midland Scottish Omnibuses Ltd	Oban	01631 563244
Morrison Bus service	Tobermory	01688 302220

Farmers

name	location	contact
Glenaros	Aros	01680 300340 or 01631 770369
Golden Ducat Farming Co. Ltd	Tobermory	01688 302331

Oil depot

name	location	contact
Gleaner oils	Craignure	01680 812 374

Camping/caravan sites

name	location	contact
Balmeanach	Fishnish	01680 300342
C Campbell	Fionnphort	01681 700213
Killiechronan Campsite	Loch na keal	01680 300 403
Shieling Holidays	Craignure	01680 812 496

- **Countrywide wildlife groups that could be contacted**

The below groups all have an interest in marine wildlife rescue and could be contacted for advice and also to find out what equipment and resources they have.

name	**address**	**role**
Earthkind	humane education centre bounds green road London N22 4EU tel: 0181 889 1595 fax 0181 881 7662 email: info@earthkind-uk.web	-Ocean defender- wildlife rescue ship and take rescued animals to wildlife hospitals -help collect oiled birds

Friends of the earth	01222 229577	- did analysis on the *Sea Empress* disaster
Greenpeace		-fact finding for campaigning reasons -Have semi-rigid inflatable boasts with experienced crews that can be deployed.
Seal Conservation Society Peter Haddow	The Manse Methick Aberdeenshire Tel/fax: 01651 806 215	
Maplethorpe Animal Gardens and seal trust Paul King	North End Mablethorpe Lincolnshire LN12 1QG tel: 01507 473346	
Seal and Wildlife Rescue/save our seals Peter Stocker	15a St Peters Road Great Yarmouth Norfolk NR30 3AY tel 01493 393 947	
Severn area Marine Life Rescue Rob Macklin	The Old Byre Willowbrook End Sutton Benger Wilts SN15 4SW tel: 01452 546 001	
Skegness Natureland Seal sanctuary Duncan Yeadon	North Parade The promenade Skegness Lincolnshire PE25 1DB	
West Norfolk Seal Rescue Service Brenda and Alan Giles	77, Gayton Road Kings Lynn Norfolk PE30 4EH tel: 01553 774349	
Isle of Man Seal Sanctuary Malcolm and Frances Walkden	Rosemere Cottage Ballafesson Port Erin Isle of Man IM9 6TE tel/fax 01624 835 744	
Grampian Wildlife Rehabilitation Trust Laurence Brain	40, High Street New Deer Aberdeenshire tel 01771 644489	
Highland Wildlife Hospital trust	Old Bank House Argyle street Ullapool Ross-shire IV26 2UB tel 01854 612 166	
Hilliswick Wildlife Sanctuary Jan Morgan	The Booth Hilliswick Shetland ZE2 9RW tel: 01806 503 348	
Orkney Seal Rescue Ross Flett	Dyke End South Ronaldsay Orkney KW17 2TJ	- House the mobile oiled bird-cleaning unit. Portacabin fitted out with 6-8 gas-fired washers and a water tank plus coupling for mains

	tel: 01856 831 463	electric and water. Unit can be transported to any such incident.
Dyfed Wildlife Trust Mick Bains	01239 820 235	-Was involved in clean up of *Sea Empress*. -effects of oil spills on cetaceans
Welsh Marine Life Rescue	Liddeston House Milford Haven Pembrokeshire SA73 3PZ tel: 01646 692 943	
Hessilhead Wildlife Rescue Trust Gay & Andy Christie	Gateside Beith Ayrshire tel/faz:01505 502 415	

From 4.2 Identify available equipment and its location.

- Equipment available for wildlife rescue.

Name	**equipment**	**contact**
RSPCA/SSPCA	- FASTANKs - Raceway, Rapide and EEzeBOX tanks (S.Connolly pers. comm.) - mobile oiled bird cleaning unit	Provided by the company Fast Engineering Ltd. Old Mill Industrial Estate Tel 01849 428 686 Orkney.
Argyll and Bute council	4 oil spill response trailers based in Campbeltown, Rothesay, Oban and Helensburgh. Each trailer has stocks of absorbent pads, masts and brooms, brushes, buckets, bins (for disposal) protective clothing, signs and covers/plugs for drains (A. Taylor pers. comm.).	
MCA	The Aerial surveillance equipment is available contracted out by MCA. (N.Clamp pers. comm.)	Atlantic Air Transport

From 7.3.1 Seal rescue kit (as carried by Sea life centre pers. comm.)

- lectade plus
-lubricating jelly
-surgical spirit
-hibiscrub
-saline
-sterilising bottles
-feeding bottles
-gastric levage tube
-towel
-gloves
-cotton wool
-digital thermometer
-funnel
-oxytet spray
-pen/notes
-identification pictures

From 7.4.3 Cetacean refloatation kit.

Useful items to take

- sacking
- buckets and shovels
- stakes and ropes
- wellington boots and protective clothing
- torches
- firemen's pump
- stretchers
- lifting equipment
- boats (to escort animals away)
- notebook and pencil
- camera
- measuring tape
- plastic bags
- first aid box for human injury
- soap, nail and disinfectant (for human)
- local tide information
- local contacts- vet, flying club, women's voluntary service,
- 2 way radio

(list provided by RSPCA).