CETACEAN STRANDINGS INVESTIGATION
SCOTLAND

PROJECT REPORT TO
THE THEN DEPARTMENT OF THE
ENVIRONMENT, TRANSPORT AND THE
REGIONS

REFERENCE - CRO179

Project period 12 June 1995 - 31 March 2000
BY
The Scottish Agricultural College
Veterinary Science Division
Drummondhill
Stratherrick Road
Inverness
IV2 4JZ

Data used in this report was collected between 1 January 1995 and 31 December 1999
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The Veterinary Science Division has eight laboratories in Scotland situated in Inverness, Thurso, Perth, Edinburgh, Aberdeen, Ayr, Dumfries and St. Boswells, with each laboratory having a staff of veterinary pathologists and support from scientific and administrative personnel.

SACVSD maintains close links with research institutes and universities and the Inverness Centre has since 1988 developed a particular interest and expertise in marine mammal health and disease. The Inverness Centre has good working relationships with other institutes working with marine mammals including SMRU, IOZ, CVL, SOAEFD Marine Laboratory, and Aberdeen University Department of Zoology.

ABBREVIATIONS

ASCOBANS Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
CVL Central Veterinary Laboratory, Weybridge
DEFRA Department for Environment, Food and Rural Affairs
DETR Department of the Environment, Transport and the Regions
DOE Department of the Environment
IOZ Institute of Zoology
MAFF Ministry of Agriculture, Fisheries and Foods
NHM Natural History Museum
NMS National Museums of Scotland
SAC The Scottish Agricultural College
SACVSD The Scottish Agricultural College Veterinary Science Division
SERAD The Scottish Executive Rural Affairs Department
SMRU The Sea Mammal Research Unit, St Andrews
SSPCA Scottish Society for Prevention of Cruelty to Animals
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1. HISTORY

SACVSD has been involved in the investigation of deaths in marine mammals since 1988 when a morbillivirus epidemic affected a large number of common and grey seals around the UK coast.

Since 1992 SACVSD has been contracted by the Wildlife and Countryside Directorate of the former DETR, now part of DEFRA, to "Investigate and co-ordinate marine mammal strandings in Scotland" under contract PECD 7/8/212 and then "Cetacean Strandings Investigation, Scotland" under contract CRO 179.

2. BACKGROUND

The UK is a party to ASCOBANS which came into force on 29 March 1994. Under this Agreement, range states are committed to co-operate in research, management and other measures needed to conserve dolphins, porpoises and other small cetaceans in the North Sea (including the English Channel) and the Baltic. The UK Government is applying the spirit of the Agreement in all UK waters.

The Conservation and Management Plan that forms an integral part of ASCOBANS specifically requires that "Each party shall….establish an efficient system for ….retrieving by-catches and stranded specimens and to carry out… full autopsies in order to collect tissues for further studies and to reveal possible causes of death and to document food composition. The information collected shall be made available in an international database."
3. EXECUTIVE SUMMARY

During this five year project, 703 cetacean carcases have been recorded as stranded or by-caught from Scottish waters and 278 of these, comprising 14 species, have been subject to necropsy. In addition, 75 seals of 4 species have also been examined post mortem.

The strandings network and reporting structure has been maintained and developed so that, as well as an effective reporting network being present, there are many organisations and individuals who assist in securing carcases, species identification and transport. As reporting is entirely voluntary, this is a personally developed network which takes time to create and effort to maintain, but is vital to the success of the project.

This project has shown the value of a pathology-based scheme in providing information on cetacean natural history and behaviour as well as disease.

There has been the first record of a Fraser’s dolphin in UK waters, the first record of Pygmy sperm whale in Scottish waters and increasing numbers of Striped dolphins which, until recently, were not thought to occur in Scottish waters.

The behavioural work has been of major importance. Firstly it was discovered that the Moray Firth population of bottlenose dolphins was killing porpoises (54 over the reporting period) and further to this it was shown that the same population was killing young bottlenose dolphins in their first year of life. This was the first description of infanticide in any cetacean species and was the most common cause of death in this population, accounting for at least 20% of all live births over the period. These findings led to two papers in the Proceedings of the Royal Society (Biology) and since then aggressive behaviour in dolphins has been described elsewhere including Cardigan Bay and the USA.

Infectious disease and parasitism has been shown to be an important cause of death in many species of cetacean in Scottish waters. There have been important findings regarding disease, particularly in bacterial diseases. Brucella genus bacteria, which are significant pathogens of terrestrial mammals, were first discovered in marine mammals in Scotland in 1991. During the project period there have been increasing numbers of Brucella isolates and the role of Brucella with disease in marine mammals has been investigated.

The pathological processes associated with live strandings have been studied and this has led to links with the range of organisations and individuals dealing with live stranding events. This work should help decision-making and improve the welfare of live-stranded animals.

Cetacean necropsies, along with the material and samples that are retained from each case, are an important and valuable scientific resource. Skeletal material from every case and whole skeletons from a number of animals has been given to the National Museums of Scotland as part of their reference collection and for skeletal pathology investigations.

There has also been a wide range of collaborative research including toxicological investigations, dietary analyses, reproductive studies, genetics, fisheries interactions and collaborative ventures which are likely to develop as the database and tissue archives increase.
In particular, close relationships have developed with National Museums of Scotland, Aberdeen University and the Sea Mammal Research Unit and this liaison helps to produce an integrated and co-ordinated approach to cetacean research.
## 4. DATA SUMMARY

Summary of Marine Mammal Strandings (Scotland) 1 Jan 1995 - 31 Dec 1999

We received reports of 703 stranded cetaceans and 527 stranded pinnipeds during the above period and the breakdown of species is listed below.

<table>
<thead>
<tr>
<th>CETACEANS</th>
<th>No. of animals reported</th>
<th>No. necropsied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harbour porpoise</td>
<td>302</td>
<td>169</td>
</tr>
<tr>
<td>Atlantic white-sided dolphin</td>
<td>53</td>
<td>17</td>
</tr>
<tr>
<td>Minke whale</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Long-finned pilot whale</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>Common dolphin</td>
<td>37</td>
<td>12</td>
</tr>
<tr>
<td>Risso's dolphin</td>
<td>34</td>
<td>5</td>
</tr>
<tr>
<td>Striped dolphin</td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td>Sperm whale</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>White-beaked dolphin</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Bottlenose dolphin</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Killer whale</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Sowerby's beaked whale</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Northern bottlenose whale</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Pygmy sperm whale</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cuvier's beaked whale</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fraser's dolphin</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>CETACEAN (sp. indet.)</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>COMMON/ STRIPED DOLPHIN</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>DOLPHIN (SP. INDET.)</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>LAGENORHYNCHUS SPP.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>MYSTICETE</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>ODONTOCETE</td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>

CPR.07 15th November 2000
### PINNIPEDS

<table>
<thead>
<tr>
<th>Species</th>
<th>No. of animals reported</th>
<th>No. necropsied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common seal</td>
<td>129</td>
<td>46</td>
</tr>
<tr>
<td>Grey seal</td>
<td>208</td>
<td>23</td>
</tr>
<tr>
<td>Hooded seal</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Harp seal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>SEAL (sp. indet.)</td>
<td>184</td>
<td>0</td>
</tr>
</tbody>
</table>

5. **OBJECTIVE 1:** To continue to manage an operational structure for the notification, investigation and recording of marine mammal (cetaceans and seals) strandings and by-catches in Scotland. Emphasis and priority for resources will be given to cetaceans.

The reporting structure which was established during the previous strandings contract continues in that it is believed that the general public in discovering a carcase will not report to a central point and are best allowed to report to diverse agencies who are then encouraged to report centrally to the Scottish Coordinator. All such bodies and agencies are continually reminded of the importance of passing on reports to the coordinator in an effort to achieve efficiency of reporting and accuracy of data. These agencies and bodies include H.M. Coastguard, Police, S.S.P.C.A., Scottish Natural Heritage (SNH), Scottish Wildlife Trust (SWT), District Council Environmental Health Departments and Countryside Ranger Services, Greenpeace, and various other national and local conservation groups.

Volunteers have been identified in most coastal sectors to provide assistance with species verification where carcases cannot be visited or collected by the coordinator. Wherever possible verification of species identification is validated by collection of voucher material or photography. In each incident the stranding is added to the database at the Inverness Veterinary Centre where it receives a unique reference number and this number together with basic morphometric and location data is forwarded to NMS in Edinburgh where it is added to the database in the Natural History Department. The data is passed from there to the IOZ for seals and to NHM for cetaceans.

All skulls which are recovered and selected complete skeletons are donated to NMS, Edinburgh, for further verification of species and addition to their cetacean research collection. Skeletal material from carcases examined at IOZ is also passed to NMS for addition to the cetacean collection and ensures the scientific accuracy of national cetacean records as well as encouraging collaboration between interested parties.

Public awareness is promoted by media contributions, talks to local organisations, and the production and distribution of small cards giving details of who to contact in the event of discovering a stranded marine mammal. These cards have been distributed widely including to every coastal post office in Scotland.

The coordinator has arranged to receive reports and, where appropriate, carcases notified under the voluntary bycatch reporting scheme operated by SERAD, whose fisheries officers assist with transport of carcases to the nearest SAC Veterinary Centre.

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6. OBJECTIVE 2: To maintain strategies, protocols, and arrangements for the investigation of marine mammal strandings and the collection of samples necessary for studies of cetacean biology and health.

The carcases subjected to post-mortem examination are selected using the following criteria:

1. Condition of carcase which is assessed by discussion with the person reporting the stranding.
2. Accessibility of carcase.
3. Rarity of species (again mainly based on description by the reporter).

All necropsies are carried out in accordance with the guidelines produced by Kuiken & Baker (1993) (Appendix 1) and samples added to the tissue archive held at SACVSD, Inverness.

There have been 703 cetacean carcases recorded as stranded or by-caught in this five year period and 278 of these have been subject to necropsy. 75 seals of four species have also been examined post-mortem. Morphometric data from all these incidents is recorded in a database (RapidFile - Ashton-Tate) in the Inverness Centre and is also passed to NHM and IOZ.

7. OBJECTIVE 3: To monitor the causes of disease and death in marine mammals and changes in their pattern of incidence.

Interpretation of the significance of pollutant burdens and changes in population performance indicators in cetacean species requires an understanding of the naturally occurring diseases and accidents within these populations. The nature and extent of natural mortality and illness among North Sea populations remain largely unrecorded and the current contract serves partly to further extend knowledge in this area.

A breakdown of all cetacean necropsies is given for 1995 – 1999 and location maps are located at section 15 of the report.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>By-catch</th>
<th>Bottlenose dolphin Kill</th>
<th>Other Trauma</th>
<th>Infectious disease/ parasitism</th>
<th>Other</th>
<th>No Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>27</td>
<td>1</td>
<td>10</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>1996</td>
<td>36</td>
<td>1</td>
<td>21</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>1997</td>
<td>37</td>
<td>11</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1998</td>
<td>29</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>9</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Harbour porpoise 1995 – 1999

169 Post mortem examinations 302 Strandings recorded
Comments:

There has been a marked reduction in porpoise numbers where the cause of death was attack by bottlenose dolphins in the second half of the project period. However, during the same period there has also been a reduction in porpoise stranding incidents around the Moray Firth area.

This is of concern in that it could reflect a population decline in porpoises, a population decline in bottlenose dolphins, or a decline in both populations.

In 1992/1993, during the previous project, there was a peak in porpoise strandings in the Moray Firth during the mid-summer months. This pattern has also not been repeated.

There was an increase in by-catch diagnoses during 1997, but this was partly as a reflection of the By-care programme, where observers were present on boats.

Infectious disease and, particularly lung parasitism, is common in porpoises. There was an increase in the number of diseased porpoises in 1998 and 1999. During these years more porpoises were found from outwith the Moray Firth so it may not reflect a true increase in disease, but may only show differences in causes of death in areas where porpoises are not attacked by bottlenose dolphins.

A pneumonic porpoise had pathology consistent with a Mycoplasma infection and a Mycoplasma was recovered from the lung. This appears to be the first description of Mycoplasma pneumonia in free-living porpoises.

In late 1999, a porpoise was found in the West of Scotland which had died from trauma inflicted by a dolphin species. There were multiple rakes on the skin and the spacings suggested that the attack had been carried out by Atlantic white sided dolphins. The injuries were less severe than those inflicted by bottlenose dolphins, but were ultimately fatal. This is the first record of another dolphin species attacking porpoises in Scottish waters.

Neoplasia appears to be rare in free-living cetaceans, but a porpoise that died from a ruptured cervix and secondary peritonitis at parturition was found to have a squamous cell carcinoma affecting the cervix and uterus.

<table>
<thead>
<tr>
<th>1999</th>
<th>40</th>
<th>8</th>
<th>3</th>
<th>2</th>
<th>19</th>
<th>5</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>169</td>
<td>26</td>
<td>54</td>
<td>5</td>
<td>42</td>
<td>18</td>
<td>24</td>
</tr>
</tbody>
</table>

Atlantic white-sided dolphin 1995 – 1999

17 Post mortem examinations 53 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 M2408/95</td>
<td>24/11/95</td>
<td>Harris</td>
<td>F</td>
<td>140</td>
</tr>
<tr>
<td>2 M2438/95</td>
<td>4/12/95</td>
<td>Lewis</td>
<td>F</td>
<td>225</td>
</tr>
<tr>
<td>3 M18/96</td>
<td>6/1/96</td>
<td>Galloway</td>
<td>M</td>
<td>252</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>M89/96</td>
<td>17/1/96</td>
<td>Mull</td>
<td>F</td>
</tr>
<tr>
<td>5</td>
<td>M395/96</td>
<td>13/3/96</td>
<td>Raasay</td>
<td>M</td>
</tr>
<tr>
<td>6</td>
<td>M181/97</td>
<td>26/1/97</td>
<td>Sutherland</td>
<td>M</td>
</tr>
<tr>
<td>7</td>
<td>M675/97</td>
<td>27/3/97</td>
<td>Mallaig</td>
<td>M</td>
</tr>
<tr>
<td>8</td>
<td>M989/97</td>
<td>4/5/97</td>
<td>Shetland</td>
<td>M</td>
</tr>
<tr>
<td>9</td>
<td>M1265/97</td>
<td>6/6/97</td>
<td>Lewis</td>
<td>F</td>
</tr>
<tr>
<td>10</td>
<td>M2117/97</td>
<td>12/9/97</td>
<td>Moray Firth</td>
<td>M</td>
</tr>
<tr>
<td>11</td>
<td>M2154/97</td>
<td>27/9/97</td>
<td>Moray Firth</td>
<td>F</td>
</tr>
<tr>
<td>12</td>
<td>M2788/97</td>
<td>5/12/97</td>
<td>South Uist</td>
<td>F</td>
</tr>
<tr>
<td>13</td>
<td>M2900/97</td>
<td>21/12/97</td>
<td>Moray Firth</td>
<td>F</td>
</tr>
<tr>
<td>14</td>
<td>M70/98</td>
<td>12/1/98</td>
<td>Cromarty Firth</td>
<td>M</td>
</tr>
<tr>
<td>15</td>
<td>M1591/98</td>
<td>24/7/98</td>
<td>Orkney</td>
<td>M</td>
</tr>
<tr>
<td>16</td>
<td>M1696/98</td>
<td>6/8/98</td>
<td>Moray Firth</td>
<td>M</td>
</tr>
<tr>
<td>17</td>
<td>M2821/98</td>
<td>30/12/98</td>
<td>Shetland</td>
<td>M</td>
</tr>
</tbody>
</table>

**Comments:**

1. M2408/95 Immature dolphin. Live stranded.
4. M89/96 No diagnosis.
5. M395/96 Live stranding but also evidence of possible viral infection.
7. M675/97 By-catch.
8. M989/97 Terminal circulatory failure. Not feeding and in poor condition but no cause found.
11. M2154/97 Live stranding.
12. M2788/97 Systemic *Brucella* infection.
15. M1591/98 Live stranding but with probable congenital lung abnormality compromising respiration.

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17. M2821/98  Live stranding of maternally dependant young dolphin.

Atlantic white-sided dolphins are an oceanic species. It is considered that oceanic species are more likely to live strand as they are unfamiliar with coastal topography and may make navigation errors. Live stranding was the most common cause of death in this group, but a number of animals were suffering from significant systemic disease. In particular, four of these animals had systemic infections with Brucella (24%).

This is the highest percentage of Brucella disease seen in any of the species examined.

Therefore, it cannot be assumed that this species is healthy if they are found live stranded.

There were two cases of by-catch, both in the West Highlands/Western Isles area.

**Minke whale  1995 – 1999**

**10 Post mortem examinations  50 Strandings recorded**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 M1333/95</td>
<td>18/7/95</td>
<td>Peterhead</td>
<td>M</td>
<td>585</td>
</tr>
<tr>
<td>2 M1723/95</td>
<td>31/8/95</td>
<td>E. Ross</td>
<td>M</td>
<td>363</td>
</tr>
<tr>
<td>3 M2124/95</td>
<td>21/10/95</td>
<td>Gairloch</td>
<td>M</td>
<td>780</td>
</tr>
<tr>
<td>4 M2394/95</td>
<td>29/11/95</td>
<td>Firth of Forth</td>
<td>M</td>
<td>700</td>
</tr>
<tr>
<td>5 M1975/96</td>
<td>19/10/96</td>
<td>Bute</td>
<td>F</td>
<td>486</td>
</tr>
<tr>
<td>6 M1990/96</td>
<td>20/10/96</td>
<td>Skye</td>
<td>F</td>
<td>850</td>
</tr>
<tr>
<td>7 M1606/97</td>
<td>15/7/97</td>
<td>Shetland</td>
<td>M</td>
<td>460</td>
</tr>
<tr>
<td>8 M2193/97</td>
<td>20/9/97</td>
<td>Wester Ross</td>
<td>F</td>
<td>753</td>
</tr>
<tr>
<td>9 M2655/97</td>
<td>19/11/97</td>
<td>Moray Firth</td>
<td>M</td>
<td>248</td>
</tr>
<tr>
<td>10 M803/98</td>
<td>9/4/98</td>
<td>Sutherland</td>
<td>F</td>
<td>~450</td>
</tr>
</tbody>
</table>

**Comments:**

1. M1333/95  No diagnosis.
3. M2124/95  Entanglement.
4. M2394/95  No diagnosis.
9. M2655/97 Stillborn (severe gales before find).
10. M803/98 Possible entanglement.

Entanglement has been the single most important cause of death. The most common entanglement has been with single ropes, either mooring ropes or, particularly, creel ropes which become entangled around the tail stock and lead to drowning.

There were also two instances of live stranding of juvenile animals. One had been frightened ashore by a killer whale and despite attempts at refloatation, it had to be euthanased. The other stranded itself and, again, despite refloatation, it continued to strand and had to be euthanased. There were no signs of disease and it was concluded that it was a maternally dependant animal that may have become separated from or lost its dam.

Two whales were killed by collisions with shipping (these were not examined). One whale was killed by an ocean tug in the Moray Firth. The other was killed by a boat in the Firth of Forth.

Long-finned pilot whale 1995 – 1999

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1094/95</td>
<td>8/6/95</td>
<td>Glenluce - Dumfries &amp; Galloway</td>
<td>M</td>
<td>585</td>
</tr>
<tr>
<td>M1327/95 A</td>
<td>17/7/95</td>
<td>Orkney</td>
<td>M</td>
<td>487</td>
</tr>
<tr>
<td>M250/96</td>
<td>17/2/96</td>
<td>Sutherland</td>
<td>F</td>
<td>138</td>
</tr>
<tr>
<td>M737/96</td>
<td>29/4/96</td>
<td>Wester Ross</td>
<td>F</td>
<td>468</td>
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<tr>
<td>M1844/96</td>
<td>2/10/96</td>
<td>Thurso</td>
<td>M</td>
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<tr>
<td>M1453/97</td>
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<td>M</td>
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<td>F</td>
<td>380</td>
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<tr>
<td>M640/99</td>
<td>12/11/99</td>
<td>Shetland</td>
<td>M</td>
<td>534</td>
</tr>
</tbody>
</table>

Comments:
1. M1094/95 Live stranding.
2. M1327/95 A Live stranding.

In all cases where a diagnosis could be reached, the cause of death was from live stranding. This species is one of the most likely to live strand and it is also the species that is most likely to be involved in mass strandings, due to its social structures.

There was no evidence of disease in any of these animals, but pathological examinations have shown central nervous system and circulatory changes which occur after live stranding which suggest that many of the live stranding incidents may not be candidates for refloating.

**Common dolphin  1995 – 1999**

**12 Post mortem examinations  37 Strandings recorded**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M874/95</td>
<td>10/5/95  Kippford – Dumfries &amp; Galloway</td>
<td>M</td>
<td>230</td>
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<tr>
<td>2</td>
<td>M1843/95</td>
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<tr>
<td>3</td>
<td>M516/96</td>
<td>1/4/96 Stranraer</td>
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<td>4</td>
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<td>8</td>
<td>M452/97</td>
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<tr>
<td>9</td>
<td>M1243/98</td>
<td>6/6/98 Shetland</td>
<td>M</td>
<td>148</td>
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<tr>
<td>10</td>
<td>M1611/98</td>
<td>27/7/98 Moray Firth</td>
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<tr>
<td>11</td>
<td>M592/99</td>
<td>5/9/99 Benbecula</td>
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<tr>
<td>12</td>
<td>M596/99</td>
<td>13/9/99 Fife</td>
<td>F</td>
<td>184</td>
</tr>
</tbody>
</table>

Comments:

1. M874/95  Entanglement in stake nets.
2. M1843/95  Live stranded.
8. M452/97 Possible live stranding.
11. M592/99 Very poor condition but was still feeding. No diagnosis.

Elsewhere in the UK this is the second most common species examined and is commonly involved in by-catch. This has not been the case in Scottish waters during the study period.

As an oceanic species there have been a number of live strandings, but a noticeable feature of many of this species has been very heavy burdens of Anisakis worms in the cardiac stomach.

---

**Risso’s dolphin 1995 – 1999**

**5 Post mortem examinations**

**34 Strandings recorded**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>M610/95</td>
<td>3/4/95</td>
<td>Sutherland</td>
<td>M</td>
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<tr>
<td>M1235/96</td>
<td>16/7/96</td>
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<tr>
<td>M1675/96</td>
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<td>Skye</td>
<td>F</td>
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<tr>
<td>M1839/98</td>
<td>25/8/98</td>
<td>Caithness</td>
<td>F</td>
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</tbody>
</table>

**Comments:**

1. M610/95 By-catch.
2. M1235/96 Decomposed carcase but probable entanglement.

There is considered to be a resident population of Risso’s dolphins around the North West coast of Scotland.

There have been few necropsies, but there are suggestions that, as with Minke whales, this species may be prone to entanglement.

### Striped dolphin 1995 – 1999

#### 16 Post mortem examinations 33 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
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</tr>
<tr>
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<td>M325/95</td>
<td>10/2/95</td>
<td>F</td>
<td>188</td>
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<tr>
<td>3</td>
<td>M1668/95</td>
<td>24/8/95</td>
<td>M</td>
<td>221</td>
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<tr>
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<td>M</td>
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<td>5</td>
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<td>M</td>
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<td>8</td>
<td>M474/98</td>
<td>3/3/98</td>
<td>M</td>
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<tr>
<td>9</td>
<td>M949/98</td>
<td>28/4/98</td>
<td>F</td>
<td>159</td>
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<tr>
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<td>21/2/99</td>
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<td>11</td>
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<td>M</td>
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<td>12</td>
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<td>M642/99</td>
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<td>26/11/99</td>
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<td>16</td>
<td>M656/99</td>
<td>14/12/99</td>
<td>F</td>
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</table>

**Comments:**

1. M40/95 Juvenile dolphin. Poor condition from probable maternal separation. *Brucella* infection.
2. M325/95 Live stranding.
3. M1668/95 Live stranding.
4. M251/96 A Live stranding.
5. M251/96 B  Live stranding.
12. M626/99  Live stranded maternally dependant dolphin. Had been feeding and there were no signs of disease. Weather had been severe.

Before 1988, when this species was found for the first time in Scotland, it was thought that they were not a normal part of the Scottish marine fauna.

Strandings records have increased during the current project period, so it would appear that this species is a normal part of the marine fauna.

This is an oceanic species and live strandings of what appeared to be healthy animals were the single most common finding.

A young animal was found to have a *Brucella* infection, but this was probably due to condition loss rather than the cause.

A significant finding was that at the end of 1999, three animals that live stranded all had meningitis and *Brucella* was recovered from the brains. In these cases the live strandings may have been due to the central nervous infection and pathology. These three animals were all from different areas of Scotland.
Sperm whale 1995 – 1999

8 Post mortem examinations 31 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
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</thead>
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<td>M546/95</td>
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<td>Grampian</td>
<td>M</td>
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<td>M143/96 B</td>
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<td>Grampian</td>
<td>M</td>
<td>1285</td>
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<td>M143/96 C</td>
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<td>Grampian</td>
<td>M</td>
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<td>M143/96 D</td>
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<tr>
<td>M143/96 F</td>
<td>28/1/96</td>
<td>Grampian</td>
<td>M</td>
<td>1365</td>
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<tr>
<td>M695/98</td>
<td>6/8/97</td>
<td>Sutherland</td>
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</tr>
</tbody>
</table>

Comments:
1. M546/95 Live stranded.
2-7 M146/96 A-F Live strandings.
8 M1695/98 Live stranded.

Sperm whale strandings are not uncommon in Scotland particularly in the Northern and Western Isles. Many of the animals have died at sea and their carcases are washed ashore.

However, live stranding events are also common, either singly or as mass strandings. Only males are found at Northern latitudes. It is assumed that they make navigation errors in tidal areas, but researchers have suggested that the North Sea may be a sperm whale ‘trap’.

White-beaked dolphin 1995 – 1999

15 Post mortem examinations 30 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
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<td>M1796/95</td>
<td>10/9/95</td>
<td>Sutherland</td>
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<td>Age</td>
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<td>5</td>
<td>M421/96 18/3/96</td>
<td>Shetland</td>
<td>M</td>
<td>176</td>
</tr>
<tr>
<td>6</td>
<td>M995/96 7/6/96</td>
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</tr>
<tr>
<td>7</td>
<td>M1491/96 21/8/96</td>
<td>Sutherland</td>
<td>F</td>
<td>143</td>
</tr>
<tr>
<td>8</td>
<td>M1505/96 23/8/96</td>
<td>Firth of Forth</td>
<td>M</td>
<td>266</td>
</tr>
<tr>
<td>10</td>
<td>M870/97 19/4/97</td>
<td>Fife</td>
<td>F</td>
<td>206</td>
</tr>
<tr>
<td>11</td>
<td>M2862/97 12/12/97</td>
<td>Orkney</td>
<td>M</td>
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<td>M2690/98 3/12/98</td>
<td>Lothian</td>
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<tr>
<td>15</td>
<td>M491/99 13/3/99</td>
<td>Lothian</td>
<td>F</td>
<td>187</td>
</tr>
</tbody>
</table>

**Comments:**

1. **M644/95** Live stranded but also with haemorrhagic cystitis and genital herpes infection.
2. **M1309/95** Stillborn.
3. **M1796/95** Decomposed with no specific diagnosis but neonate.
4. **M1924/95** Decomposed, possible live stranding.
5. **M421/96** No diagnosis.
6. **M995/96** Neonate, not fed, probable separation from dam.
7. **M1491/96** Parasitic pneumonia, toxaemia.
8. **M1505/96** Live stranding.
9. **M1519/96** Decomposed. No diagnosis.
10. **M870/97** Possible viral infection with *Brucella* infection.
11. **M2862/97** Bacterial meningoencephalitis.
12. **M1288/98** Live stranding.
13. **M2690/98** Live stranding. Pneumonia.
14. **M390/99** Juvenile dolphin. Live stranded, but had fish caught in throat and had ‘choked’.
15. **M491/99** Live stranding.

There has been no consistent pattern to white-beaked dolphin strandings.
There have been three live strandings without evidence of disease, one stillbirth and one neonatal death, but five animals were diseased.

Two had possible underlying viral infections and one of these also a generalised Brucella infection.

One had a probable bacterial meningoencephalitis and two were pneumonic.

One juvenile animal died from choking and suffocation. It had attempted to swallow a Ballen wrasse, but the fish had lodged in the pharynx and had pushed the larynx out of the nasal passage.

### Bottlenose dolphin 1995 – 1999

12 Post mortem examinations 18 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M1468/95</td>
<td>6/8/95  West Beach Nairn</td>
<td>F</td>
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<tr>
<td>2</td>
<td>M1545/95</td>
<td>12/8/95  Chanonry Point, Fortrose</td>
<td>M</td>
<td>147</td>
</tr>
<tr>
<td>3</td>
<td>M2563/95</td>
<td>31/12/95  Hilton of Cadboll</td>
<td>M</td>
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</tr>
<tr>
<td>4</td>
<td>M774/96</td>
<td>6/5/96  Findochty Harbour</td>
<td>M</td>
<td>274</td>
</tr>
<tr>
<td>5</td>
<td>M1049/96</td>
<td>17/6/96  Munlochy bay</td>
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</tr>
<tr>
<td>6</td>
<td>M2310/97</td>
<td>3/10/97  Gardenstown, Banff</td>
<td>M</td>
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</tr>
<tr>
<td>7</td>
<td>M167/98</td>
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<td>30/3/99  Shandwick, E. Ross</td>
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<td>F</td>
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<td>M591/99</td>
<td>26/8/99  MacDuff</td>
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<tr>
<td>12</td>
<td>M661/99</td>
<td>21/12/99  Balmedie, Aberdeen</td>
<td>M</td>
<td>267</td>
</tr>
</tbody>
</table>

**Comments:**

1. M1468 Young dolphin, less than 1 year old. Death from bottlenose dolphin (BND) attack, bacterial skin disease.

2. M1545/95 Young dolphin, less than 1 year old. Death from BND attack, bacterial skin disease.

3. M2563/95 Probable live stranding. Possible viral skin infection.

4. M774/96 By-catch in illegal salmon nets.

5. M1049/96 Death due to possible viral lung infection.

6. M2310/97 Young dolphin less than 1 year old. Death from BND attack.

CPR.07 15th November 2000


Infanticide was the most common cause of death. This finding was published in the Proceedings of the Royal Society and was the first description of infanticide in any cetacean species.

There was evidence of bacterial skin disease in the young animals but no good evidence of skin disease in older animals. A report to Aberdeen University, SMRU and DETR was produced in 1997 detailing the findings of bottlenose dolphin necropsies and skin changes.

There were two by-catch cases, both in Findochty. These were reported to SERAD.

The Moray Firth population of bottlenose dolphins is of major conservation and economic importance. Work from Aberdeen University has shown that the loss of an adult female each year means that the population is not sustainable. In 1999 the carcases of three adult or sub-adult females were found.

### Killer whale 1995 – 1999

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1878/97</td>
<td>16/8/97</td>
<td>Harris</td>
<td>F</td>
<td>610</td>
</tr>
</tbody>
</table>

**Comments:**

Old female with worn teeth and infected gums, unable to feed.

### Sowerby’s beaked whale 1995 – 1999

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
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CPR.07 15° November 2000
<table>
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<th>Date</th>
<th>Location</th>
<th>Sex</th>
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<td>6/10/96</td>
<td>Firth of Forth</td>
<td>M</td>
<td>269</td>
</tr>
</tbody>
</table>

**Comments:**


There was no evidence of disease in these animals. They are deep sea whales and had probably made navigation errors to arrive in the Firth of Forth.

**Northern bottlenose whale 1995 – 1999**

1 Post mortem examination 3 Strandings recorded

<table>
<thead>
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<th>Reference</th>
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<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
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<td>Stranraer</td>
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</tr>
</tbody>
</table>

**Comments:**

Decomposed carcase. No diagnosis.

**Pygmy sperm whale 1995 – 1999**

2 Post mortem examinations 2 Strandings recorded

<table>
<thead>
<tr>
<th>Reference</th>
<th>Date</th>
<th>Location</th>
<th>Sex</th>
<th>Length cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>M618/99 A</td>
<td>18/10/99</td>
<td>Stranraer</td>
<td>F</td>
<td>268</td>
</tr>
<tr>
<td>M618/99 B</td>
<td>18/10/99</td>
<td>Stranraer</td>
<td>-</td>
<td>208</td>
</tr>
</tbody>
</table>

**Comments:**

This is the first record of Pygmy sperm whale (*Kogia breviceps*) in Scotland. This was a pregnant female with calf and both had live stranded on mud-flats. There was no evidence of disease.
In other areas, particularly South Africa and S. E. USA, this is one of the most common species involved in strandings. Often it is a female with calf that strands.

This species has also recently been recorded in England, Wales and Ireland, so this may represent a recent change in the species range.

SEALS

Seals are not covered by the ASCOBANS agreement, but previously DETR had agreed to the continuation of a small number of seal necropsies to maintain a ‘watching brief’ on seal mortality incidents in case there were further epizootics, as in the morbillivirus epizootic of 1988/89.

Over the course of the project the number of seal reports has fallen sharply as, due to reduced numbers of seal necropsies, there is a feeling of inaction amongst members of the public and a reluctance to make the effort to report carcases.

We have examined seal carcases that have been tagged by Aberdeen University and SMRU researchers and passed findings on to them.

We have examined a number of seals that had been shot by illegal methods. Details were passed on to Police Wildlife Liaison officers, SERAD and SSPCA.

Several Hooded seals and a single Harp seal were identified during the project period. This is of interest as these are considered to be arctic species.

Serological studies have shown that exposure to Brucella appears to be common in seals, particularly Grey seals. However, disease associated with infection has been rare.

Two notable exceptions were two Brucella-associated pneumonia cases in young seals. Both of these seals were in rehabilitation centres and posed a potential zoonotic risk to the staff as well as a potential source of infection for other species.

BACTERIOLOGY (Report by Geoff Foster)

Brucella
The discovery that members of this zoonotic genus infect sea mammals almost certainly represents the most significant bacteriological finding since the sea mammal strandings project began. To date Brucella has been recovered from forty-five animals comprising nine different species as follows:

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>harbour porpoise</td>
<td>15</td>
</tr>
<tr>
<td>Atlantic white-sided dolphin</td>
<td>6</td>
</tr>
<tr>
<td>striped dolphin</td>
<td>5</td>
</tr>
<tr>
<td>common dolphin</td>
<td>2</td>
</tr>
<tr>
<td>white-beaked dolphin</td>
<td>1</td>
</tr>
<tr>
<td>common seal</td>
<td>10</td>
</tr>
<tr>
<td>hooded seal</td>
<td>3</td>
</tr>
<tr>
<td>grey seal</td>
<td>2</td>
</tr>
<tr>
<td>otter</td>
<td>1</td>
</tr>
</tbody>
</table>

CPR.07 15th November 2000
In addition to the above, serological evidence of infection, although by no means conclusive, has been found in bottlenose dolphin, Sowerby’s beaked whale, killer whale, long-finned pilot whale, sperm whale, harp seal and ringed seal.

**Salmonella**
A monophasic group B salmonella has been isolated from fifty-eight harbour porpoises up to the end of 1999. The organism has not been recovered from any other species thereby increasing the suspicion that it may be host-adapted to porpoises. Surprisingly for members of this genus, lung rather than intestine has been the most frequent source of isolation.

*S. typhimurium* DT104 a common serotype from human and livestock infections was recovered from the small intestine of a juvenile grey seal in the Moray Firth. This animal had been tagged ten weeks previously in the Firth of Forth, an area where water samples had tested positive for the same organism. Another phage type of *S. typhimurium*, DT12, was recovered from a porpoise.

Another serotype which frequently causes human salmonellosis, *Salmonella enteritidis* DT4, was recovered in septicaemic distribution from a common seal in a rehabilitation centre. Amongst domesticated animals this strain is more commonly isolated from poultry.

Other *Salmonellae* recovered include *S. bovismorbificans* from two grey seals and an otter, *S. dublin* from a common seal and *S. tennessee* from another common seal.

**Campylobacter**
*Campylobacter* species were recovered from three common seals and a porpoise. The four strains were all identical and further work is underway to determine whether they are a novel species.

**Yersinia**
*Yersinia enterocolitica* was cultured from an Atlantic white-sided dolphin and a porpoise. Other Yersinia isolates include *Y. frederiksenii* from a porpoise and a common seal; *Y. rohdei* from a porpoise and a grey seal and *Y. intermedia* from a common seal.

**Vibrios**
*Listonella damsela*, an organism associated with life-threatening wound infections and septicaemia in humans has been the most commonly recovered *Vibrio*; it has been cultured from ten harbour porpoises, five striped dolphins, four Risso’s dolphins, three white beaked dolphins, one bottle nose dolphin, one Sowerby’s beaked whale, one minke whale, one sperm whale and one grey seal. Vibrio alginolyticus is the next most frequently isolated member of this group having been isolated from seven animals. The many other Vibrio isolates have include *Vibrio anguillarum* and *Vibrio metschnikovii*.

**Bordetella**
*Bordetella bronchiseptica* was recovered on numerous occasions as a secondary bacterial infection in seals during the *morbillivirus* epizootic in seals in the late 1980s. It was subsequently isolated from three common seals and a grey seal in 1993, a grey seal in 1997 and a common seal in 1999.

**Pasteurellaceae**
Members of this family are among the most common isolates from sea mammals, most of which are likely to be novel. To date two new species, *Actinobacillus delphinicola* and *A. scotiae* and a new genus *Phocoenobacterium uteri* all isolated from cetaceans have been described. *A. scotiae* has been recovered from three septicaemic carcases.

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24
**Erysipelothrix**

*Erysipelothrix rhusiopathiae* has been a recognised cause of septicaemia in cetaceans for many years. It has also been a noted cause of human wound infection and it has been suggested that it is the cause of seal finger. *Erysipelothrix* septicaemias have been recorded from five porpoises and one white-beaked dolphin, but also from one harp seal, one grey seal pup and an otter.

**Arcanobacterium phocae**

*Arcanobacterium phocae* a novel species from seals was described in 1997. Since then it has also been isolated from a porpoise. It has been isolated from various infected sites, often with other Gram positive organisms e.g. *Str. phocae* (see below) anaerobic bacteria or *Pasteurellaceae*. Associated infections have included several cases of eye infection in captive seals, other purulent lesions and septicaemia.

**Streptococcus phocae**

First reported by Skaar in 1994 from septicaemic seals, this organism or a close relative has been isolated on many occasions from seals and cetaceans, often in mixed culture.

**Staphylococcus delphini**

This coagulase positive species initially isolated from purulent skin conditions of two captive dolphins by Varaldo was recovered from the nose of a common seal.

**Mycoplasma**

A mycoplasma species was recovered from the lung of a porpoise in 1993 and mucus from the lung of another porpoise in 1999.

Other novel bacterial species and genera described since the sea mammal strandings project began include *Cetobacterium ceti*, *Corynebacterium phocae* and *Abiotrophia balaenopterae*.

**VIRAL CONDITIONS**

The most common viral condition in cetaceans has been genital herpes which has been seen in a number of species, including porpoises, white beaked dolphins and sperm whales.

The genital herpes infections may be of little pathological significance, though one animal had a concurrent haemorrhagic cystitis.

However, two porpoises have been found with a herpes virus encephalitis. It is unknown whether the encephalitic infection and genital infections are due to the same virus.

Suspect viral skin lesions have been found on porpoises. One animal had a large skin lesion in a ‘snake-like’ pattern with white skin, but no skin thickening. Histopathological examination showed that the thickness of the keratinised layer varied. There was a zone of swollen pale cells below this, some of which contained intracytoplasmic inclusions. The dermal papillae were inflamed.

Atlantic white sided dolphins have had suspect viral infections affecting the mouth and oesophagus with full thickness epidermal necrosis.

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Some of the mucosal lesions have been reminiscent of pestivirus lesions in ruminants. Pestiviruses such as Bovine Virus Diarrhoea virus in cattle and Border Disease virus in sheep are of considerable importance, so it would be a significant finding if such viruses occur in cetaceans.

Morbillivirus is well documented as a significant pathogen of marine mammals and it is likely that there are many other viral pathogens. The development of viable cetacean cell lines and serological tests are required to allow this work to progress and this is an important area for development in further projects and research.
8. **OBJECTIVE 4:** To collect and provide appropriate tissue samples from selected species to allow contaminant levels to be determined and to use data obtained to provide an assessment of long-term changes and effects on health.

All contaminant analyses on samples obtained from Scottish strandings have been carried out at the FRS Marine Laboratory in Aberdeen under Dr. David Wells in the Chemistry department. Analyses have been carried out on a limited number of samples as SERAD funds have permitted and two papers published. No external funding has been found to have all samples analysed but appropriate samples are held in the archive at the Inverness Centre to ensure their access for any future analyses.

**FRS Marine Laboratory Report by Craig McKenzie.**

**Environmental Contaminants in the Tissues of Marine Mammals from Scottish Waters - Collaboration with the Scottish Agricultural College, Veterinary Centre.**

The concentrations of potentially toxic contaminants in marine mammals stranded along the Scottish coast have been monitored since 1990 as part of the UK national survey. As part of the information base on these stranded animals, chlorobiphenyls (CB), including toxic ‘dioxin like’ congeners, organochlorine pesticides (OCPs) and trace metals (cadmium, copper, mercury, lead, selenium, tin and zinc) have been determined in the tissues of 13 marine mammal species. Work has focussed upon assessing the risk of different marine mammal species to the effects of environmental contaminants.

The study has shown that for most species concentrations of organic contaminants are at the low end of the concentration range measured in similar species worldwide. Bioaccumulation patterns of organic contaminants between species differ due to dietary and physiological differences with each species having an identifiable CB pattern. During 1996/1997 FRS analysed 9 bottlenose dolphins (8 from the Moray Firth, 1 from Gareloch) and 6 sperm whales (from a mass stranding at Cruden Bay) for organic contaminants. (For bottlenose dolphin results see "The Influence of Environmental Contaminants on Skin Disease in Bottlenose Dolphins"; Report to MAFF & DETR by SMRU & Aberdeen University, Project MF 0516, September 1997)

Previously published data on contaminant patterns in harbour porpoise and grey seal blubber has been used in a collaborative study with institutes from Denmark, England, Norway and the Netherlands. A paper reporting the findings of the study has been accepted for publication.

Laboratory work has focussed on the determination of trace metals in the tissues of marine mammals stranded on the Scottish coast. A list of samples analysed is given in Table1. Where possible both liver and kidney samples from the same animal have been analysed.

Organotin compounds, which may suppress the immune system similarly to CBs, were implicated to have caused immune dysfunction in bottlenose dolphins stranded on the South East U.S. Atlantic and the Gulf of Mexico between 1989 and 1994. During 1997 FRS analysed livers and kidneys from marine mammals inhabiting Scottish waters for total tin concentrations (inorganic + organic tin compounds). Results of the analysis of trace metals in samples provided by SAC are being prepared for publication.

Research has also involved investigation of the factors controlling bioaccumulation of environmental contaminants within species, with harbour porpoise, bottlenose dolphins, Atlantic
white-sided dolphins (in collaboration with U.C. Cork) and sperm whales being analysed together with an investigation of contaminants in their diet.

FRS investigated environmental contaminants in the increased number of sperm whales stranded around the Scottish coast between 1993 and 1996. Since 1992 36 sperm whale carcasses have been identified and of these 29 stranded between 1994-1996. Blubber samples from 20 animals were analysed for CBs and OCPs and in addition 7 samples were obtained from strandings in Belgium and The Netherlands. The concentrations in the sperm whales were at the lower end of the concentration range for CBs and OCPs determined in other marine mammals from the Scottish coast. The bioaccumulation pattern of organic contaminants showed that the sperm whales differed from other marine mammals. CB patterns in sperm whales were more dependent on diet, metabolism and animal condition than the location of stranding. Trace metals were determined in 4 of 6 sperm whales stranded at Cruden Bay, Grampian. Concentrations of metals such as cadmium and mercury were high (median concentrations of 17 and 23µg/g respectively) reflecting a diet (cephalopods) rich in these elements.

Publications


Table 1
Samples analysed by FRS for trace metals (Cd, Cu, Hg, Pb, Se, Sn and Zn)

<table>
<thead>
<tr>
<th>Species</th>
<th>Liver</th>
<th>Kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grey Seal</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Common Seal</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>Harbour Porpoise</td>
<td>52</td>
<td>36</td>
</tr>
<tr>
<td>Bottlenose Dolphin</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Common Dolphin</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Risso’s Dolphin</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>White Beaked Dolphin</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>White Sided Dolphin</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Striped Dolphin</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Pilot Whale</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Minke Whale</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sowerby’s Beaked Whale</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Unknown</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

9. OBJECTIVE 5: To maintain a tissue archive and database for Scottish strandings and by-catch data.

All data on strandings and by-catches are held in a database (RapidFile - Ashton-Tate).

SACVSD currently hold the tissue archive in three large chest freezers and a large upright freezer with selected tissues held in an ultrafreezer at –80°C.

In addition, bacteriological samples are also stored in an ultrafreezer at –80°C.

This is a scientifically valuable collection and it may be useful to have aliquots of these samples held at a separate site to avoid the danger of sample loss due to power or equipment failures.

This important resource, along with other samples taken at necropsy, have led to a number of collaborative projects. Our collaborators include:

Aberdeen University - genetics, dietary analysis, teeth ageing and estimation of reproductive condition is currently carried out by collaboration with researchers in the Department of Zoology.

National Museums of Scotland - skeletal pathology and species confirmation.

Durham University - Genetics.
Sea Mammal Research Unit - Fisheries interaction.

Kingston University - biodegradable proteins and cell line establishment.

Moredun Research Institute - Neuropathology.

Bangor University - acoustics especially sperm whales.

British Divers Marine Life Rescue - live strandings.

10. OBJECTIVE 6: To advise DETR, other Government Departments and other bodies on the significance of, and responses to, marine mammal mortality incidents.

Throughout the project, MAFF’s (now Defra’s) State Veterinary Service have been kept fully informed of the location and identity of *Brucella* isolates from seamammals and have been provided with appropriate material for further research at the Central Veterinary Laboratory. Advice on safe working procedures has been provided to MAFF, SERAD and other relevant bodies.

In addition, advice has been given on zoonotic risks from marine mammals to government departments, veterinary and medical colleagues, including hospital consultants, universities, SSPCA, WDCS and members of the public.

The Receiver of Wreck was notified in all incidents involving Royal fish (cetaceans over 25 feet long excluding pilot and bottlenose whales) and advice on local situations was given where appropriate.

Illegal activities, where these were identified at necropsy examinations, were reported to police wildlife liaison officers, SERAD and SSPCA. These included use of monofilament nets in a bottlenose dolphin by-catch and seals having been shot by shotgun.


Information has been supplied to DETR to fulfill ASCOBANS requirements.

T. Patterson acts as a veterinary adviser and B. Reid as a scientific adviser to British Divers Marine Life Rescue. This organisation deals with the rescue of live stranded marine mammals.

T. Patterson and B. Reid are both members of MARC (Marine Mammal Rescue Coalition).
11. OBJECTIVE 7: To liaise closely with other contractors in the Cetacean Strandings Programme and those carrying out similar work in Northern Ireland, to ensure that all work contributes to a coherent UK approach.

The transfer of information including biological data is well established with NHM and appears to be operating satisfactorily.

Data transfer between SAC and IOZ, who carry out similar work for England and Wales, has occurred; good relations have been built with Paul Jepson, the England and Wales strandings programme veterinary pathologist.

Relations have also been built with our European colleagues.

T. Patterson attended a Sperm whale necropsy workshop in Denmark, 26 – 27 May 1998, where all the northern European strandings programmes workers were present.

B. Reid has visited Dr E. Rogan, Cork University to develop relations with the Irish strandings programme workers.

While no official link has been made with organisations in Northern Ireland, we have a good relationship with several key individuals.

12. CONCLUSIONS

1. The strandings network and reporting procedures have been developed and refined and are operating effectively. There are many individuals and organisations throughout Scotland who will now assist in securing carcases, identification and transport.

2. The project has been valuable in providing information on cetacean natural history.

Specific examples include the first record of a Fraser’s dolphin in UK waters, the first record of pygmy sperm whale in Scottish waters and increasing numbers of striped dolphins in Scottish waters.

3. A major output of this project has been in demonstrating that a pathology-based programme can provide valuable information on cetacean behaviour.

From necropsy examinations, it was shown that bottlenose dolphins in the Moray Firth were killing harbour porpoises.

It was then shown that these bottlenose dolphins were killing young bottlenose dolphins in the same population. This was the first description of infanticide in any species of cetacean.

Since the publications in the Proceedings of the Royal Society (Biology) similar aggressive behaviour has been seen with bottlenose dolphins elsewhere, including Cardigan Bay and USA.
4. Post mortem examinations have been carried out on 14 different species of cetacean and 4 different species of seal. This provides information and material for research from many species which are either rare or are infrequently seen alive.

5. Studies on disease in free-living cetaceans, particularly those associated with bacterial disease, has also been a major output of the project.

The most important example has been the work on Brucella, where prior to 1991 in Scotland, no Brucellae from non-terrestrial sources had been found. Work is continuing on investigations of disease associated with marine Brucellae and valuable collaboration has been set up with Dr J. Godfoid, Veterinary and Agrochemical Research Centre, Brussels, Belgium where molecular studies will characterise the bacteria and determine their evolution.

6. Pathological studies of live stranded cetaceans have been valuable in understanding the processes that occur after an animal strands. This will help those organisations who are involved in live animal rescue to make decisions on whether to refloat or to euthanase and will aid the welfare of the individuals or groups of animals concerned.

7. A very important result of the strandings programme is that a wide range of tissues and archived samples are available as a resource for other researchers. This has been of particular importance in this contract as such areas of work as toxicological analyses and dietary analyses have not been funded direct via the project. As shown in Objective 7 a wide range of collaborative projects is already underway and as the numbers of samples builds, particularly from rarer species, collaborative research will increase.

8. This project has to be part of a long-term study as short-term interpretation of either strandings data, analyses of stored samples or pathological findings may be misleading. For example, in 1995 porpoise strandings in the Moray Firth were frequent whereas in 1999 they were uncommon in this area. This could either be as a result of short-term population movements or may reflect longer-term changes but this will not be known without further work.

Also, the scientific value of stored material increases, not only with the number of samples kept, but more importantly with the time span covered.

13. RECOMMENDATIONS FOR FUTURE WORK

It is important that the programme is continued as only long-term work will be able to provide information on trends or changes in such areas as populations, disease, pollutant levels, diets and reproduction, but there are a number of specific areas that should also be addressed in the shorter term.

It is our opinion that more investigation of the role of pollutants in relationship to disease should be carried out. This work should focus on a species which is common right around the coast of the UK and where carcases can be easily separated into diseased or otherwise so that there would be suitable numbers for meaningful statistical interpretation. Therefore, in the UK this work should
focus on harbour porpoises. This would also complement the work being carried out by our European colleagues. This work should develop so that as well as finding out whether there are toxicological differences between diseased and other porpoises, possible differences between ages, sexes and areas of the UK are investigated. For these reasons it is important that the single co-ordinated project is effective and that toxicological analysis is funded as a core element.

Progress is also required with virological studies of cetaceans in UK waters. The significance of this group of agents is not in doubt considering the severity of Morbillivirus outbreaks in many areas. In many species Morbillivirus outbreaks are cyclic so it is possible that further epizootics may occur but further epidemiological study is required.

However, there are likely to be many unrecognised viral pathogens in cetaceans and for virological research to develop cell lines must be available. This would require collaborative links with specialist virological units and a joint UK approach would also be valuable for this.

There are considerable logistic problems when dealing with large whales, both from the point of view of disposal and of post mortem examination. We have asked in the past that the Receiver of Wreck were able to provide information on how to deal with large carcasses including advice for contractors on what type of equipment to use. The Receiver of Wreck duty for Scotland has now passed to the Scottish Executive and it would be useful for SERAD to produce contingency plans for large whales. Decomposition in large whales is extremely rapid and any useful examinations must be carried out within 24 hours of death.

In the near future it would also be valuable to create an action plan, probably under the auspices of the Receiver of Wreck, on how to deal effectively with large whale strandings. If disposal teams contracted to local councils had information readily available on systems required to remove large whales quickly and effectively from stranding sites, it would enable the strandings contractors to have access and examine the carcasses and take samples before they were too decomposed to be useful.

The present project, along with others, has highlighted concerns over the Moray Firth population of bottlenose dolphins regarding its long-term survival, as well as the apparent decline in porpoise numbers in this area. Therefore, it is important that studies continue on these populations.

A review of the role of skin diseases affecting the bottlenose dolphins was undertaken as part of the project and it is our opinion that the skin changes in adults are probably of little significance. However, there is evidence that young animals are undergoing a period of severe skin changes and this also requires further study.

Further work is also required to investigate the role of Brucella infections in particular but a number of novel bacteria have been isolated from marine mammals during the project and the role of these other agents also should be studied.
14. PUBLICATIONS


Radionuclides in seals and porpoises in the coastal waters around the UK. Watson, W. S.; Sumner, D. J.; Baker, J. R.; Kennedy, S; REID, R: Robinson, I. SCIENCE OF THE TOTAL ENVIRONMENT. August 30, 1999 v234 i1-3 p1-13
Register, K. B., Sacco, R. E. and FOSTER, G. Ribotyping and restriction endonuclease analysis reveal a novel clone of \textit{Bordetella bronchiseptica} in seals. (submitted for publication).


Thompson, P. M., Corpe, H. M. & REID, R. J. Prevalence and intensity of the ectoparasite \textit{Echinophthirius horridus} on harbour seals (\textit{Phoca vitulina}); effects of host age and inter-annual varialibity in host food availability.1998 Parasitology 117, 393-403


15. OTHER PUBLICITY

In addition to publications, many talks have been given to local natural history groups throughout Scotland to promote the project and to develop public awareness both of cetacean biology and of the strandings programme. These help to maintain the operational structure for the notification of cetacean strandings and by-catches as well as publicising cetacean research, particularly to the general public. Other such measures included:

Talks have also been given to SACVSD, Scottish Wildlife Trust, Heriot Watt University Marine Biology Department and the Association of Veterinary Teachers and Research Workers.

Post mortem demonstration seminars have been given to Aberdeen University Lighthouse Field Station staff, Aberdeen University BSc zoology students, Aberdeen University MRes and MSc marine and fisheries science students, Stirling University Veterinary Aquaculture MSc students, British Divers Marine Life Rescue staff and a number of other individuals.

Post mortem findings reports are sent to the members of the public who reported the stranding.

There have also been numerous newspaper, radio and television interviews given both in the UK but also abroad, including USA, Australia, Japan and Denmark.

The Discovery channel made a programme, part of which featured the post mortem examination of a porpoise that had been killed by a bottlenose dolphin.

European Cetacean Society Conferences were attended in Portugal and Germany.

16. MAPS

The following pages show the distribution of cetacean species found stranded.
GUIDELINES FOR THE POSTMORTEM EXAMINATION AND TISSUE SAMPLING OF CETACEANS

CONTENTS
a) Introduction
b) Basic measurements
c) External examination
d) Examination of abdominal organs (except G.I. tract, pancreas, and spleen)
e) Examination of organs of head, neck and thorax
f) Examination of the G.I. tract, pancreas and spleen

a) Introduction

These guidelines are meant primarily as an aid to veterinary surgeons carrying out postmortem examinations on stranded cetaceans in the U.K., as a part of the DoE-funded marine mammal projects in England, Wales, and Scotland. They are based partly on guidelines written by Dr John Baker, University of Liverpool, and partly on the protocol produced at the European Cetacean Society workshop on cetacean pathology, held in Leiden, The Netherlands, in September 1991.

All structures must be examined visually and by palpation, making incisions into the organs. A full post mortem record must be kept, preferably on the standard "cetacean postmortem report” form.

Lesions in any organs should be described, photographed and sampled. The description should include the size, location, colour, texture, shape, and the nature of the transition from normal to abnormal tissue. Photographs should include a ruler or similar object to indicate the size of the lesion. According to the suspected etiology of the lesion, samples should be collected for bacteriological examination (especially if the lesion is of a purulent nature), for virological examination, and for parasitological examination. In all cases, a sample of the lesion should be preserved for histopathological examination.

Any parasites found, regardless if they are associated with pathological lesions or not, should be preserved in 70% ethanol for identification. An attempt should be made to estimate the total number of parasites. Some predilection sites for parasites are indicated in the text.

If the state of decomposition of the carcass is advanced (condition code 4 or 5, see below), only the basic measurements, organ weights (when possible), and a limited number of samples (epidermis, skull, teeth, food remains, gonads) should be taken.

The postmortem examination need not take place in the order described below. However, samples for bacteriological and virological examination need to be taken as early as possible. Also, examination of the G.I. tract should be left until last to prevent cross-contamination with enteric micro-organisms.

Paul Jepson

b) Basic measurements

photographs Photographs should be taken of the lateral views of the whole body, from both sides. Particularly in bottle-nosed dolphins, photographs should be taken of the
Estimate the body condition, that is the state of decomposition of the carcass, using the categories of the condition code\textsuperscript{1}.

Weigh the carcass. If this is not possible, the body weight can be estimated from the heart weight\textsuperscript{2}.

Measure the body length by placing the carcass on its belly, holding a measuring tape or ruler next to the carcass in a straight line parallel to the longitudinal body axis and measuring the distance between the notch in the tail flukes and the tip of the upper jaw. Measure the body girth at the level of the anterior insertion of the dorsal fin.

c) External examination

Indicate the nutritional state of the carcass, using one of the following three categories:
- good: the aspect of the upper flanks on either side of the dorsal fin is rounded;
- moderate: the aspect of the upper flanks on either side of the dorsal fin is sloping;
- poor: the aspect of the upper flanks on either side of the dorsal fin is hollow (in these animals, one can make out the transverse processes of the lumbar vertebrae, and there is an indentation dorsally just behind the head).

Examine the body orifices (mouth, eyes, ear openings, blow-hole, anus, genital slit and mammary slits) for lesions and any discharge. Collect and preserve left and right eyes separately in 10\% formalin (only if both eyes are fully intact).

Examine the animal for external lesions and sample these accordingly. Examine the skin carefully for any ectoparasites. These are most likely to be found in or near the body orifices and next to the fins and flukes. Take a 4 cm\textsuperscript{2} piece of epidermis down to the blubber for DNA-studies, and freeze.

Massage the skin in the area cranial to the mammary slits in a caudal direction to express any fluid present in the mammary glands. If fluid can be pressed out, collect a sample for organochlorine analysis in a hexane-washed glass container and freeze. If the lid is made of plastic, separate the sample from this with aluminium foil. Note the volume, colour, and consistency of the fluid.

Cut a transverse strip of blubber about 2 cm wide from the anterior insertion of the dorsal fin, from the mid-dorsal to the mid-ventral region. Make sure to cut at right-angles to the surface of the skin. Measure the thickness of the blubber strip with a ruler 2cm lateral to the dorsal mid-line, mid-laterally, and 2cm lateral to the ventral mid-line. (Using this method, the tension of the blubber tissue is relieved before measuring.)

Cut a strip of blubber a few cm wide and a few cm long at the level of the caudal insertion of the dorsal fin. Make sure to cut at right-angles to the surface of the
skin. Measure the thickness of the blubber strip 2 cm lateral to the dorsal mid-line. From this blubber strip, take 2x20 g cross-sectional samples of blubber for organo-chlorine analysis. It is important to take samples of the whole layer, from the skin to the muscle. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes.

**muscle**

Take 2x20 g muscle samples for toxicological analysis, at the same location as and directly below the blubber sample, at the level of the caudal insertion of the dorsal fin. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes.

With the animal on its right side make a mid-line ventral incision from the symphysis of the mandible to a short distance posterior of the anus, circumventing the genital slit and anus. From the posterior end of the ventral incision make a second one almost to the dorsal mid-line. Reflect the skin and blubber off the uppermost side. Any parasites in the blubber should be noted and collected. They may occur as white cysts less than 1 cm in diameter, often in the ano-genital region or the dorsal aspect of the chest wall.

**mammary gland**

In females, examine the mammary gland for pathological changes and parasites. Collect a cross-sectional slice of about 1 cm thick from halfway along the length of the left mammary gland for histopathological examination, and place in 10% formalin.

**subcutaneous tissue**

Examine the subcutaneous tissue for the presence of bruises and parasites.

**scapula**

Remove the left scapula for (future) radionuclide analysis and freeze.

**d) Examination of abdominal organs (except G.I. tract, pancreas, and spleen)**

Remove the left abdominal wall, freeing the testis or ovary and uterus. Any parasites in the abdominal wall (for instance cysts under the peritoneum) should be collected. Remove the left thoracic wall, for example with bone shears.

**rib**

Remove the fifth left rib and freeze a 15 cm section of it.

**virology samples**

Before handling the internal organs, take two 1 cm³ samples of lung tissue from the cranio-ventral part of the left lung and a 1 cm³ sample of kidney tissue from the left kidney for virological examination. Also take a sample of lung tissue from the cranio-ventral part of the left lung, a sample of kidney tissue from the left kidney, a sample of liver tissue from the left lobe of the liver, and a sample of heart blood from the right ventricle, for bacteriological examination.

Sever the intestine close to the anus and the oesophagus close to the diaphragm. Working forward along the dorsal aspect of the abdominal cavity, remove the stomach, intestines, pancreas, spleen and mesenteric lymph node, attached to each other, from the carcass. Leave the examination of the G.I. tract to the end of
the postmortem examination to prevent cross-contamination of other tissues with enteric micro-organisms.

**urinary bladder**
Open and examine the bladder in situ, noting the contents, if any. Preserve a 1cm³ sample of the bladder in 10% formalin (for histopathology).

**female repr. tract**
In females remove the entire reproductive tract, open the vagina and uterus, note any corpora lutea, corpora albicantia or follicles on each ovary and then place the ovaries separately in 10% formalin for reproduction studies. Preserve a 1cm³ sample of the uterus in 10% formalin (for histopathology).

**foetus**
If a foetus is present of sufficient size to examine the individual organs, a postmortem examination and tissue sampling of the foetus can take place in the same way as for cetaceans after birth. If it is too small for a full postmortem examination, the whole foetus and its placenta can be wrapped in hexane-washed aluminium foil and stored frozen for organochlorine analysis.

**male repr. tract**
In males remove the testes and weigh them separately after removing the epididymis. After incision and examination, place the testes in 10% formalin for reproductive studies. If they are heavier than about 50 g each, place a cross-sectional slice about 1 cm thick from mid-way along the length in 10% formalin. Examine the penis and preputium.

**adrenal glands**
Remove and examine the adrenal glands, and place them separately in 10% formalin.

**kidneys**
Remove the kidneys from the body cavity and weigh them. Incise both kidneys longitudinally, and if possible, strip the capsule. Then, take 2x20 g samples for toxicological analysis from halfway the length of the left kidney. These samples should be cross-sectional and include both medullary and cortical tissue. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes. Preserve 1 cm³ from a kidney in 10% formalin for histopathological examination.

**liver**
Remove and weigh the liver. Examine both surfaces and make multiple incisions into the substance. Examine the bile ducts for parasites. Then, take 2x20 g for trace metal analysis. These samples should include approximately equal amounts of tissue from the edge of the left lobe, the edge of the right lobe, and the hilus of the liver. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes. Place 1 cm³ of liver tissue in 10% formalin for histopathological examination.

**e) Examination of organs of head, neck and thorax**

**thyroid**
Carefully remove the superficial muscles overlying the trachea and larynx to expose the thyroid gland. Examine this tissue and preserve 1 cm³ of tissue in 10% formalin for histopathological examination.
Incise along the internal aspects of both mandibles and free the tongue. Once the tongue is free reflect it backwards and cut the hyoid bones close to the skull.

Free the larynx from the sphincter muscle holding it in place and pulling the tongue backwards incise along the neck to free the trachea and oesophagus. Then, incising dorsally and ventrally in the thoracic cavity, free the heart and lungs. Note any attachments of the lungs to the thoracic walls. This procedure should give you the tongue, larynx, trachea, oesophagus, thymus, heart and lungs all still fastened together.

tongue
Examine the surface of the tongue.

oesophagus
Open the oesophagus longitudinally and check for lesions or parasites.

respiratory tract
Open the larynx, trachea and major bronchi longitudinally. Make multiple incisions into the substance of both lungs. Any parasites should be collected. Two pieces of lung (about 1 cm³) from the hilus and periphery of the left lung, and the same from the right lung, should be collected in 10% formalin for histopathological examination. The samples should include part of the major bronchial tree. Repeat this procedure, placing the second set of samples in a separate container with 10% formalin for morbillivirus detection using an immunoperoxidase test. Open all major branches of the pulmonary veins and examine for the presence of parasites. Examine the bronchial and so-called "pulmonary associated" lymph nodes. The latter can be found about halfway along the ventral edges of each lung. Cut a 1 cm thick cross-sectional slice from the middle of the left pulmonary associated lymph node, and place it in 10% formalin for histopathological examination.

thymus
Examine and weigh the thymus, if present (noting the presence of any macroscopic cysts). Place 1 cm³ of thymus in 10% formalin for histopathological examination.

serum
Collect any blood present in the heart lumen, to obtain serum for serological examination. The serum, acquired by centrifugation, should be stored frozen. Even if it is haemolytic, it is still of value.

heart
Separate the heart from the lungs by cutting through the major blood vessels where they enter the heart. Open the left and right ventricles and atria for examination and to take out any blood clots present. Any parasites should be collected. Weigh the heart. Cut a 1 cm thick slice of heart tissue, to include a piece of the wall of the left ventricle and of the atrioventricular septum, and place it in 10% formalin for histopathological examination.

tympanic bulla
Examine the tympanic bullae (which in cetaceans are not part of the skull but lie free just behind the mandibles). Carefully dissect each tympanic bulla (and associated cochlea) free of their connective tissue attachments to the skull. Examine the internal cavity of each bulla and recover any nematodes present (with forceps). Preserve the left tympanic bulla/cochlea and right tympanic...
teeth (baleen plates) If possible, remove two sets of (at least) 4 teeth from the middle of the lower jaw for ageing, and store frozen (separately). (In baleen whales, cut off 2 baleen plates as near as possible to their basis and store frozen.)

brain In freshly dead carcasses (condition code 2), open the skull, and examine the brain.

The skull can be opened by making a vertical cut parallel and about 2 cm posterior to the transverse dorsal ridge which is clearly visible and palpable on top of the skull. The second cut should be made in the horizontal plane, through the occipital condyles, making sure to leave the posterior portion of the condyles on the skull, so that the condylo-basal length can still be measured. Both cuts should be extended until they meet each other. The separated piece of skull can then be pried loose using a chisel or flat-bladed screwdriver, and the brain can be removed.

Take a 1 cm³ sample of brain for virological examination. Place the rest of the brain in 10% formalin for at least a week. To allow faster fixation, a longitudinal incision can be made in the cerebrum to expose the lateral ventricles. When it is fixed, make multiple slices into the tissue to look for pathological lesions, including the presence of parasites. Take 1 cm³ samples of the cortex, midbrain, cerebellum, and medulla, for histopathological examination. Dissect the pituitary gland from the pituitary fossa (located in the cranial floor) and preserve in 10% formalin.

skull In more decomposed carcasses, leave the skull intact. Both opened and completely intact skulls should be stored frozen for morphometrics studies.

f) Examination of the G.I. tract, pancreas and spleen

spleen Examine and weigh the spleen and put a piece (about 1 cm³), including a section of capsule, in 10% formalin for histopathological examination. One often finds smaller accessory spleens near to the main spleen.

pancreas Examine the pancreas. Look for parasites, particularly in the pancreatic ducts. Place a 1 cm³ piece of pancreas tissue in 10% formalin for histopathological examination.

mesenteric ln. Examine the mesenteric lymph node and put a 1 cm thick cross-sectional slice from halfway its length in 10% formalin for histopathological examination.

stomach Open the cardiac section of the stomach. Collect any fish bones, otoliths and other food remains and preserve in 70% ethanol or freeze for prey studies. Any parasites should be collected. Describe any lesions, including the distribution and size of any ulcers.

Open the fundic and pyloric sections of the stomach. Any food material and parasites should be preserved as for the cardiac section. Any nodules in the walls...
of the fundic and pyloric sections should be noted and, if they are found, attempts should be made to express the contents. Any parasites found in the contents should be collected.

**Intestine**

Free the intestine from the mesentery and open the entire length of the organ collecting any contents in a bucket. The contents should be diluted with water and sieved through a 500 m sieve to collect otoliths and other recognisable food remains. These should be stored in 70% ethanol (or alternatively stored frozen). Any parasites should be collected.

1. The body condition, or state of decomposition of a carcass, can be described using the following condition code:
   1) **live** (becomes code 2 at death)
   2a) extremely fresh (as if just died, no bloating, meat is considered by most to be edible)
   2b) slight decomposition (slight bloating, blood imbibition visible)
   3) **moderate decomposition** (bloating, skin peeling, penis may be extended in males, organs still intact, excluding postmortem damage)
   4) **advanced decomposition** (major bloating, skin peeling, penis extended in males, organs beyond recognition, bones exposed due to decomposition)
   5) **indeterminate** (mummified carcass or skeletal remains, no organs present)

2. The body weight can be estimated from the heart weight using the formula
   \[
   \log W = \frac{\log H + 2.2}{0.984}, \text{ with } H = \text{heart weight and } W = \text{body weight, both in kg.}
   \]
CETACEAN POSTMORTEM REPORT

When this report has been completed, please send a copy to: Marine Mammal Strandings Project, Veterinary Science Division, Institute of Zoology, Regent's Park, London NW1 4RY. Tel: 020 7449 6691 or 6672 Fax: 020 7586 1457
email: paul.jepson@ioz.ac.uk or rob.deaville@ioz.ac.uk

2. GROSS PATHOLOGICAL EXAMINATION

Encircle the appropriate category:  
**NE** = not examined  
**NAD** = nothing abnormal detected  
**A** = abnormal (describe fully in section 5)

### EXTERNAL EXAMINATION
- NE NAD A - body orifices
- NE NAD A - fins and flukes
- Nutritional state: good / moderate / poor

### INTEGUMENT
- NE NAD A - epidermis
- NE NAD A - blubber
- NE NAD A - subcutaneous tissue
- NE NAD A - mammary glands

### MUSCULOSKELETAL SYSTEM
- NE NAD A - skull
- NE NAD A - other bones
- NE NAD A - back muscle mass
- NE NAD A - other muscles

### NERVOUS SYSTEM
- NE NAD A - brain
- NE NAD A - spinal cord
- NE NAD A - peripheral nerves

### CARDIOVASCULAR SYSTEM
- NE NAD A - pericardial sac
- NE NAD A - myocardium
- NE NAD A - valves
- NE NAD A - arteries, veins

### RESPIRATORY SYSTEM
- NE NAD A - nasal cavity
- NE NAD A - sinuses
- NE NAD A - trachea, bronchi
- NE NAD A - lungs
- NE NAD A - pleura/pleural cavity

### ALIMENTARY SYSTEM
- NE NAD A - mouth
- NE NAD A - oesophagus
- NE NAD A - cardiac section stomach
- NE NAD A - fundic section stomach
- NE NAD A - pyloric section stomach
- NE NAD A - intestine
- NE NAD A - anus
- NE NAD A - liver
- NE NAD A - pancreas
- NE NAD A - peritoneum/peritoneal cavity

### UROGENITAL SYSTEM
- NE NAD A - kidneys
- NE NAD A - ureters
- NE NAD A - urinary bladder
- NE NAD A - urethra
- NE NAD A - ovaries/testes
- NE NAD A - uterus
- NE NAD A - vagina/penis
- NE NAD A - vulva/preputium

### LYMPHATIC AND ENDOCRINE SYSTEMS
- NE NAD A - adrenal glands
- NE NAD A - thyroid gland
- NE NAD A - spleen
- NE NAD A - thymus
- NE NAD A - lymph nodes
3. CHECKLIST OF STANDARD SAMPLES

In each square, enter:  ✓ = sample taken
Blank = sample not taken or not present
Record any extra samples taken in section 4.

Weights

left testis (g): . . . . . . 
right testis (g): . . . . . . 
heart (g): . . . . . . 
food remains cardiac section stomach (g): . . . . . . 
liver (g): . . . . . . 
kidney (g): . . . . . . 
spleen (g): . . . . . . 

Ethanol

☐ food remains all from:
☐ parasites from: pref. all

10% Formalin

☐ adrenal glands both
☐ bladder 1 cm³
☐ brain whole
☐ eyes both
☐ heart 1 cm³
☐ kidney 1 cm³
☐ liver 1 cm³
☐ lung 4 x 1 cm³
☐ lung (for morb.) 4 x 1 cm³
☐ mammary gland 1 cm slice
☐ mesenteric ln. 1 cm slice
☐ ovaries both
☐ pancreas 1 cm³
☐ pituitary whole
☐ pulm. ass. ln. 1 cm slice
☐ thymus 1 cm³
☐ uteris 1 cm³
☐ tympanic bullae/cochlea both

Freeze at -20°C

☐ blubber 2 x 20 g
☐ epidermis 4 cm²
☐ foetus/placenta whole
☐ kidney 2 x 20 g
☐ liver 2 x 20 g
☐ milk up to 20 ml
☐ muscle 2 x 20 g
☐ rib (fifth) 15 cm
☐ scapula whole
☐ serum (also haemolytic) up to 20 ml
☐ skull whole
☐ teeth (baleen plates) >4 (2 sets)

Bacteriology

☐ heart blood -
☐ kidney swab/block
☐ liver swab/block
☐ lung swab/block

Virology (freeze at -70°C)

☐ brain 1 cm³
☐ kidney 1 cm³
☐ lung
☐ lung (for PCR)  

1 cm³
## 4. LIST OF EXTRA SAMPLES

<table>
<thead>
<tr>
<th>Extra samples of lesions taken for histological examination (list):</th>
<th>Extra samples of lesions taken for bacteriological examination (list):</th>
<th>Other extra samples taken (list):</th>
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5. DESCRIPTION OF ABNORMALITIES ON GROSS PATHOLOGICAL EXAMINATION

(add extra pages if necessary)
PRELIMINARY DIAGNOSIS OF GROSS PATHOLOGICAL EXAMINATION (in order of importance):

a.

b.

c.

d.

e.
6. RESULTS OF HISTOLOGICAL EXAMINATION (add extra pages if necessary)
7. RESULTS OF BACTERIOLOGICAL EXAMINATION

Heart blood: . . . . . .
Lung: . . . . . .
Liver: . . . . . .
Kidney: . . . . . .
Other: . . . . . .

8. MISCELLANEOUS RESULTS

9. FINAL DIAGNOSIS (in order of importance):

a.

b.

c.

d.

e.