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# Formal Review of Research and Development of Contract CR0364 – Cetacean Strandings around the UK Coast

**19th December 2007**

# Formal Review of Research and Development of Contract CRO 364 – Cetacean Strandings around the UK Coast

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**Date: 19th December 2007**

Summary of Recommendations:

1. The limit on the number of post-mortems undertaken should remain capped at 100 per year. This should be reviewed triannually (in line with contract renewal) and any adjustments subjected to appropriate statistical analysis;
2. Rather than a specified total number of post mortems per species category, a range is recommended to allow flexibility and to enable spatial and temporal variations to be taken into account. The recommended annual ranges for post-mortems are 55-65 harbour porpoise, 15-20 common dolphins and 10-25 other species, with a maximum of 100 post-mortems in any one year. The proportion of post-mortems undertaken on the three species categories should be altered using strandings data on a five yearly rolling basis whilst maintaining statistical power. These numbers should be reviewed triannually with any adjustments subject to statistical analysis;
3. Using a 5 year rolling mean, the spatial distribution of post-mortems should reflect that of the strandings (25 in Scotland and 75 in England and Wales). This should be reviewed triannually;
4. The carcasses sampling rationale should be subject to an annual review and included as an appendix in the annual report;
5. Use of an existing web portal gateway for the dissemination of the strandings and post-mortem data is recommended as the most cost-effective option for making information from the scheme publicly available, with links established to a CSIP dedicated website;
6. Development of the domain www.ukstrandings.org is recommended to publicise the project and contact details. Further opportunities for dissemination of the project should also be encouraged;
7. Defra, the Devolved Administrations and JNCC should encourage participation of the Countryside Agencies in the strandings scheme given their responsibilities for delivering conservation policy;
8. The Wildlife Trusts and other appropriate organisations should be approached by the contractors to enhance coverage of the UK coastline with respect to ‘stranding reporters’. Mechanisms should also be put in place to ensure accuracy and consistency of reporting standards through, for example, the development of appropriate training schemes.

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## 1. Introduction

The main driver for the UK Cetacean Strandings Investigation Programme (CSIP) is the United Kingdom's obligation under the Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas[1] (ASCOBANS). ASCOBANS conservation and management plan states that:

*'each party shall endeavour to establish efficient system for reporting and retrieving bycatches and stranding specimens and to carry out … full autopsies in order to collect tissues for further studies and reveal possible causes of death and to document food composition. The information shall be made available in an international database'*. In addition, the conservation and management plan also states that '*Information shall be provided to the general public in order to ensure support for the aims of the agreement in general and to facilitate the reporting of sightings and strandings in particular; and to fishermen in order to facilitate and promote the reporting of bycatches and the delivery of dead specimens to the extent required for research under the agreement*.'

The UK government applies the Agreement to all UK waters despite its lack of ratification of the change in the original area of the Agreement.

The CSIP also contributes to the UK's obligations under articles 2, 11 and 12 of the 1992 EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), the 'Habitats Directive'. Member States are required:

'*to maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest* [which includes all cetaceans]…*Member States shall undertake surveillance of the conservation status of the natural habitats and species…Member States shall establish a system to monitor the incidential capture and killing of the animal species listed in Annex IV (a)* [which includes all cetaceans]. *In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned.*'

Work from CSIP contributes by indicating which human activities may be having an influence on cetacean populations, as well as providing indications of their health status.

The stranding project has been funded for the period 2007-2010 at a cost of £1,053,338 by Defra, Scottish Government (SG) and the Welsh Assembly Government (WAG). The most efficient way to meet UK obligations and responsibilities under the Habitats Directive and ASCOBANS is for Defra and the Devolved Administrations to work together with a single UK CSIP, ie the current position.

[1] At the ASCOBANS meeting of the Parties in 2006 it was agreed to change the name to the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas. The UK has still to ratify this change.

## 2. Scope of the Review

It was outlined in Section 15 of the project specification that Defra would formally review the project within two years of the start date to ensure that the project continues to meet the Department's requirements and provides value for money. Defra requested that JNCC undertake this review on their behalf in the first year of the contract CRO 364. The review was to specifically include:

- An assessment of the number of cetacean post-mortems carried out (including whether rare species should continue to be examined);
- Details on how web data services could be implemented; and
- Details on how volunteer networks could be implemented.

Depending on the outcome of this review, variations to the contract may be required to take account of changes to Defra's requirements.

Northern Ireland has not been considered within the preparation of this review as they currently participate in a stranding project with Ireland.

## 3. Review outcomes: Post-Mortems

## 3.1 Total number of post-mortems carried out annually

Historically, post-mortems have been undertaken on all carcasses reported which were in a suitable condition and accessible. The numbers of reported strandings has increased from 418 in 1992 to approximately 750 per year in recent years. This is most likely due to public awareness and the development of stranding networks in areas such as the south-west of England rather than a significant increase in the number of cetaceans stranding.

In response to this rise, a review was commissioned by Defra, Crane and Shepherd Review (2006; sometimes referred to as the Watts and Crane Review) which included an assessment of the number of post-mortems required. Watts & Shepherd (2006) used Crystal Ball Predictor, a financial and sales forecasting package, to predict most likely estimates of the number of post-mortems to be conducted in 2008 from the 2000 to 2004 data. The results of this analysis (and information on the techniques used) are not presented in the review output and thus it is unclear how these predictions were utilised in their review of CSIP in 2006. However, their power analysis indicated that a randomly selected sample of between 40-50 harbour porpoises and between 20-30 common dolphins would be sufficient to detect important trends in the common causes of death. The Crane and Shepherd Review (2006) also concluded that

'*An upper limit on the number of carcasses that should be subject to post-mortem should be set in the light of i) existing information on trends and the number of samples required to detect deviations from these trends of a defined magnitude and statistical power, ii) the level of incidence of new, currently unknown phenomena that Defra wishes to be able to detect with this scheme, and iii) the available budget. It is likely that no more than 100 cetacean post mortems need to be performed each year in the UK in order to identify major changes in the trends of commonly reported causes of death*.'

### 3.1.1 2007: Assessment of the change to post-mortem numbers

CSIP by its nature can be defined as surveillance monitoring, i.e. it is not guided by a priori hypotheses and corresponding models (Nichols & Williams, 2006). A frequent justification for surveillance monitoring is that more information must be useful for management and conservation although it is recognised this does not address the issues of effectiveness and efficiency.

Because of the nature of strandings, it is unlikely that the individuals stranding accurately reflect the population as a whole. For example, changes in weather and current patterns will influence the number of carcasses stranding. The strandings data therefore contains biases which need to be taken into account.

Assuming no significant change in the proportions of different causes of death and a random chance of any particular cause of death occurring throughout the year, the 2007 data collected in the first six months for harbour porpoises and common dolphins are as expected (Table 1).

**Table 1: Cause of death identified in 2007 (January - June inclusive) and that indicated by data obtained in most recent available 5-year period (2002-2006).**

| Species | Cause of death | Mean expected per year for 2002-2006 data (SD) | Mean expected when PM number capped | Min expected per year when capped | Max expected per year when capped | Number seen in first six months of 2007 |
|---|---|---|---|---|---|---|
| Harbour porpoise (PM capped at 45 $yr^{-1}$) | Bycatch | 24.8 (±13.4) | 9.4 | 4.3 | 14.5 | 4 |
| | Starvation | 19.4 (±6.7) | 7.4 | 4.8 | 9.9 | 6 |
| | Pneumonia | 19.4 (±6.1) | 7.4 | 5.0 | 9.7 | 2 |
| | bottlenose dolphin attack | 21.6 (±9.2) | 8.2 | 4.7 | 11.7 | 5 |
| | live stranding | 5.6 (±3.1) | 2.1 | 0.9 | 3.3 | 1 |
| | physical trauma | 6.4 (±3.7) | 2.4 | 1.0 | 3.9 | 2 |
| | generalised bacterial infection | 5.4 (±2.6) | 2.0 | 1.1 | 3.0 | 0 |
| | Other | 6.4 (±3.0) | 2.4 | 1.3 | 3.6 | 2 |
| | not established | 9.6 (±2.3) | 3.6 | 2.8 | 4.5 | 1 |
| | **Total** | **118.6** | **45** | **25.8** | **64.1** | **27** |
| Common dolphin (PM capped at 25 $yr^{-1}$) | Bycatch | 22.4 (±9.0) | 16.2 | 9.7 | 22.7 | 5 |
| | live stranding | 3.8 (±2.2) | 2.7 | 1.2 | 4.3 | 1 |
| | Starvation | 1.0 (±1.0) | 0.7 | 0 | 1.4 | 1 |
| | physical trauma | 0.8 (±0.8) | 0.6 | 0 | 1.2 | 0 |
| | Other | 2.8 (±2.3) | 2.0 | 0.4 | 3.7 | 2 |
| | not established | 3.8 (±2.6) | 2.7 | 0.9 | 4.6 | 1 |
| | **Total** | **34.6** | **25** | **12.1** | **37.9** | **10** |

**SD: Standard deviation; Min: minimum, calculated as [(annual mean – standard deviation)/mean annual total]*2007 post-mortem (PM) allocation; Max: maximum, calculated as [(annual mean + standard deviation)/mean annual total]*2007 post-mortem allocation**.

Utilising Kruskal-Wallis tests, this was confirmed statistically for both species. The data for each year (2002-2007 inclusive) was converted to proportions of 45 post-mortems for harbour porpoises and 25 for common dolphins. No significant difference was found between years for either data sets (hp: $K = 0.255$, $p>0.05$; cd: $K = 0.389$, $p>0.05$). This indicates that capping the total number of post-mortems at 100 has not lead to any significant loss of information for these two species. From a statistical point of view, 100 post-mortems appears to be enough.

### 3.1.2 Review response & recommendation

Concerns regarding the capping of the number of post-mortems were:

- Capping the overall number of post-mortem examinations could hamper or delay the ability to detect statistically or biologically significant changes in the prevalence of specific diseases or causes of death monitored through the CSIP. One of the initial purposes of the strandings project was to detect disease outbreaks and investigate any unusual mortality events. From the data collected to date, it is still possible to gain an understanding of health and disease at the harbour porpoise population level, but the currently reduced UK-wide pathological surveillance of cetacean strandings could, at least in theory, delay the detection of unusual patterns of strandings and to detect novel disease outbreaks, especially if new diagnostic tests need to be implemented;
- The reduction in carcasses collected for necropsy may lead to a less complete and robust record over time which will effect the ability to analyse trends over time. If a fresh carcass is not collected and remains on a beach (particularly the case if the location is not close to houses), this is seen by the public as a lack of interest in such carcasses and will make people disinclined to report the next one they find. If faced with another situation like the stranding of the northern bottlenose whale in the Thames in 2006, it would be awkward if a post-mortem was not performed due to there being a 'lack of interest' in the species;
- Samples and data collected from each post-mortem are used to support a broad range of interdisciplinary research. This research in turn supports a wide range of Defra policy objectives. For example, recent research on the ecological impacts of cetacean by-catch conducted by the Sea Mammal Research Unit have used samples and data derived from post-mortems of UK-stranded harbour porpoises and common dolphins. The recent SCANS II project, support by Defra and the European Union, also benefited from data derived from cetacean strandings (both by-catch and non-bycatch) which fed into management models designed to predict safe levels of by-catch for harbour porpoises in commercial fisheries (especially in years between large scale SCANS-type population surveys);
- The quality and quantity of the science is limited by the quality and quantity of the samples and data that feed into them. This is particularly relevant for the numerous scientific studies that require samples or data from cetacean species other than common dolphins and harbour porpoises. Since the start of the project in 1990 to 2006, 101 peer-reviewed publications and 12 post-graduate theses, as well as a variety of other reports, collaborations and conference presentations, have been produced which utilised tissues and/or data derived from the CSIP. The ability of the CSIP to support this broad range of policy-driven research is directly proportional to the number of cetacean species, and individuals within each species, examined annually.

A limit of 100 post mortems is considered sufficient to meet UK obligations as a signatory to ASCOBANS, which is the main driver for this work, and requirements under the Habitats Directive. It is also scientifically robust. This, however, should not deter the contractors from extracting maximum value from the funding. It is vital that ways of publicising the project are put in place to ensure effective and robust reporting of strandings with no loss of information due to a perceived lack of interest in

carcasses. Such a role could be fulfilled by a dedicated web site and appropriate mailing list, newsletters etc. The domain name www.ukstrandings.org has recently been purchased to act as such a communication/publicising point for CSIP.

It should be noted, however, that this cap of 100 post-mortems does not include exceptional events. Within the current contract, there is provision for the contractor to approach Defra for a variation in the contract to be made should such an event occur.

**Recommendation 1: The limit on the number of post-mortems undertaken should remain capped at 100 per year. This should be reviewed triannually (in line with contract renewal) and any adjustments subjected to appropriate statistical analysis.**

## 3.2 Partitioning of post-mortems between species categories

Based on the findings of the Crane and Shepherd (2006) review, the current funding period (2007-2010) limits the number of post mortems undertaken to 100 per year and consists of:

- 45 harbour porpoises;
- 25 short-beaked common dolphins; and
- 30 'other' species[1].

### 3.2.1 2007: Assessment of partitioning of post-mortems between species categories

IoZ produced a sampling rationale to randomly select 100 carcasses for annual post-mortem which examined cetacean strandings recorded in the UK over the past 10 years (1997 to 2006 inclusive). In summary, the IoZ report indicates that the distribution of post-mortems between species should be altered to reflect the proportion of strandings occurring in the UK (Table 2).

**Table 2: Estimate of the proportion of post-mortems to be undertaken on different species stranding in the UK**

| Species | 1997-2006 UK strandings (mean $yr^{-1}$ ± standard deviation) | Proportion of 100 post-mortems |
|---|---|---|
| Harbour porpoise | 300.9 ± 111.0 | 61 |
| Common dolphin | 104.3 ± 54.6 | 21 |
| Other species | 90.1 ± 11.0 | 18 |
| Total | 496 | 100 |

It has been observed that the number of reported strandings is increasing on an annual basis. Examining the stranding data on a rolling 5 yearly basis, and using these numbers to estimate the number of post-mortems conducted on particular

[1] The category 'other' species includes striped, white-sided, white–beaked, bottlenose and Risso's dolphins, minke, long-finned pilot, Sowerby's beaked, sperm, northern bottlenose, fin, Cuvier's beaked, pygmy sperm and humpbacked whales, and orcas.

species as a proportion of 100, indicates that there has been a gradual increase in the number of harbour porpoise post-mortems required whilst the numbers for common dolphins and 'other' species have fluctuated (Table 3).

The statistical power of a monitoring program is the probability of that the monitoring will detect a trend in the data despite the 'noise' associated with seasonal cycles and other fluctuations (Nichols & Williams, 2006). There are numerous techniques for undertaking power analysis (e.g Cohen, 1988; Murphy & Myors, 2004). The consequences of ignoring statistical power include the collection of data insufficient to make reliable inferences about trends or collection of data in excess of what is needed. For the purposes of this review, the probability of making a Type 1 error (concluding that a trend is occurring when it is not), termed $\alpha$ was set at 0.05, the standard value utilised in statistical tests of biological information. The power of the test, derived from the Type 2 error (concluding there is no trend when in fact there is), which is termed β and where power = 1- β, was set initially at 0.8 and also tested at 0.95.

Power analysis was undertaken using the G*power package and a $\chi^2$ *a priori* test which enabled the comparison of the proportions of each cause of death identified in post mortem results between 2002 – 2006 (Table 4). The data was treated for the UK as a whole on an annual basis. For harbour porpoises, with $\alpha$ = 0.05 and df = 28, a sample size of 52 will have a power of 0.81. To increase this power to 0.95, a sample size of 75 would be required. Additionally, this assumes that data will be collected over a 5 year period for trends to be detected. For common dolphins, with $\alpha$ = 0.05 and df = 20, a sample size of 11 will have a power of 0.84. To increase power to 0.95, a sample size of 15 is required. Similarly, data will need to be collected over a 5 year period.

**Table 3: Estimate of the proportion of post-mortems to be undertaken on different species stranding in the UK on a 5 yearly rolling basis.**

| Year | Species | UK strandings (mean $yr^{-1}$ ± standard deviation) | Proportion of 100 post-mortems |
|---|---|---|---|
| 1997-2001 | Harbour porpoise | 205.0 ± 27.5 | 55.9 |
| | Common dolphin | 66.2 ± 34.3 | 18.0 |
| | Other species | 95.6 ± 9.1 | 26.1 |
| | Yearly total range | 327 - 482 | |
| 1998-2002 | Harbour porpoise | 233.8 ± 69.3 | 56.8 |
| | Common dolphin | 81.0 ± 39.5 | 19.7 |
| | Other species | 96.8 ± 6.5 | 23.5 |
| | Yearly total range | 328 - 551 | |
| 1999-2003 | Harbour porpoise | 259.0 ± 70.8 | 55.8 |
| | Common dolphin | 113.0 ± 64.2 | 24.3 |
| | Other species | 92.2 ± 10.6 | 19.9 |
| | Yearly total range | 328 - 603 | |
| 2000-2004 | Harbour porpoise | 314.8 ± 102.6 | 58.5 |
| | Common dolphin | 135.4 ± 53.1 | 25.2 |
| | Other species | 88.0 ± 12.6 | 16.4 |
| | Yearly total range | 357 - 698 | |
| 2001-2005 | Harbour porpoise | 364.4 ± 88.6 | 61.6 |
| | Common dolphin | 141.4 ± 43.9 | 23.9 |
| | Other species | 86.0 ± 11.2 | 14.5 |
| | Yearly total range | 482 - 698 | |
| 2002-2006 | Harbour porpoise | 396.4 ± 63.7 | 63.4 |
| | Common dolphin | 142.4 ± 43.5 | 22.8 |
| | Other species | 86.2 ± 11.6 | 13.8 |
| | Yearly total range | 551 - 698 | |

**Table 4: Proportion of different causes of death between 2002 and 2006 used in power analysis**

| Harbour porpoise | | Common dolphin | |
|---|---|---|---|
| Cause of death | Proportion of deaths | Cause of death | Proportion of deaths |
| Bycatch | 0.206 | Bycatch | 0.647 |
| Starvation | 0.169 | Starvation | 0.029 |
| Disease | 0.206 | Live stranding | 0.110 |
| Bottlenose dolphin attack | 0.179 | Physical trauma | 0.023 |
| Live stranding | 0.048 | Other | 0.081 |
| Physical trauma | 0.055 | Not established | 0.110 |
| Other | 0.054 | | |
| Not established | 0.083 | | |
| Total | 1 | total | 1 |

### 3.2.2 2007: Assessment on value in conducting post-mortems on 'other species'

On average, 26.7 ± 5.0 post-mortems were undertaken on 'other species' between 2000 and 2006 inclusive. Of these post mortems, 'other species' included striped, white-sided, white-beaked and bottlenose dolphins on an annual basis (Table 5). Post-mortems on other species such as minke whales, Risso's dolphins, long-finned pilot whales and Sowerby's beaked whales occurred almost annually. Necropsies were performed on the remaining species less regularly.

The need to post-mortem rare species, in particular, has recently been questioned in light of the lack of the ability to generate statistically robust data.

Post-mortem examinations of rarer species may potentially provide an early indication that a change may be occurring in the wider population. For example, the disease status of rarer species is relevant to the general health status of the more common species with which they may come into contact with. Necropsies on rare species have also provided useful scientific findings such as the occurrence of gas bubble embolism in beaked whales and other species.

Under the current methodology, 30 post-mortems are allocated to 'other species', i.e. all cetacean species except harbour porpoise and common dolphin. From analysis of previous data it may not be possible to obtain enough carcasses of 'other species' in an appropriate condition that are accessible to meet this allocation.

The condition of a carcass is an important aspect in whether a post-mortem is conducted. Currently, carcasses that are extremely fresh or show slight decomposition (condition 2) or moderate decomposition (condition 3) depending on species are considered for necropsies in England and Wales. In Scotland, a greater proportion of post-mortems are performed on condition 3 carcasses due in part to the nature of the coastline which means it may take longer for the carcass to be detected and extended travel time to reach the site. In addition, even live stranded whales that are reported immediately will often be condition 3 by the time a post-mortem is performed. A

greater proportion of such individuals strand in Scotland compared to England and Wales (1997-2006 data: 57.8±8.2 and 8.3±6.7, respectively).

If necropsies were conducted on all condition 3 carcasses belonging to the 'other species' grouping that strand, then the current 30 quota would probably be met. However, as highlighted in section 3.2.1, it is proposed that the number of post-mortems on 'other species' should be reduced to 10-25 for the UK as a whole. This reduction would bring the number of necropsies on these species in line with the occurrence of strandings and will be sufficient to meet UK obligations under ASCOBANS and the Habitats Directive.

### 3.2.3 Review response & recommendation

A change in the proportion of post-mortems undertaken on different species is needed. As suggested by IoZ, the proportioning should more closely reflect the strandings data. A range is recommended rather than specifying a specific number to allow flexibility whilst retaining statistical power. It is recommended that post-mortems are undertaken on 55-65 harbour porpoise, 15-20 common dolphins and 10-25 other species, with a maximum of 100 post-mortems in any one year on a UK-wide basis. This should be reviewed annually using a 5 yearly rolling mean and any adjustments subject to appropriate power analysis. It should be noted, that power analysis has only been conducted at a UK scale and that it maybe more appropriate for management to undertake such analysis at a regional scale.

**Recommendation 2: Rather than a specified total number of post mortems per species category, a range is recommended to allow flexibility and to enable spatial and temporal variations to be taken into account. The recommended annual ranges for post-mortems are 55-65 harbour porpoise, 15-20 common dolphins and 10-25 other species, with a maximum of 100 post-mortems in any one year. The proportion of post-mortems undertaken on the three species categories should be altered using strandings data on a five yearly rolling basis whilst maintaining statistical power. These numbers should be reviewed triannually with any adjustments subject to statistical analysis.**

**Table 5: Post-mortems undertaken between 2000 and 2006 inclusive**

| Species | Mean ($yr^{-1}$) with standard deviation in brackets |
|---|---|
| Harbour porpoise | 117.7 (26.8) |
| Short-beaked common dolphin | 33.6 (10.5) |
| Striped dolphin | 6.3 (2.4) |
| White-sided dolphin | 5.3 (2.6) |
| White-beaked dolphin | 3.4 (1.0) |
| Bottlenose dolphin | 3.0 (1.3) |
| Minke whale | 2.0 (1.4) |
| Risso's dolphin | 2.0 (1.5) |
| Long-finned pilot whale | 1.3 (1.1) |
| Sowerby's beaked whale | 1.0 (0.8) |
| Sperm whale | 0.7 (0.8) |
| Northern bottlenose whale | 0.7 (1.5) |
| Fin whale | 0.4 (0.5) |
| Cuvier's beaked whale | 0.1 (0.4) |
| Pygmy sperm whale | 0.1 (0.4) |
| Humpback whale | 0.1 (0.4) |
| Orca | 0.1 (0.4) |

## 3.3 Spatial and temporal distribution of post-mortems

The current total post-mortem allocations under the scheme are 75 post-mortems to England and Wales; and 25 to Scotland.

Prior to 2000, the post-mortem data for England and Wales were not presented separately. Of the 4593 strandings between 2000 and 2006, 55.6% occurred in England, 24.8% in Scotland and 19.6% in Wales. These numbers include every carcasses reported regardless of whether species identification as possible or not. During this same time period, on average post-mortems were performed on 29.6% of the stranded carcasses. There was, however, variation between countries with Scotland performing a greater proportion (39.6%) than England and Wales (20.7% and 28.3%, respectively).

It is likely that the increased proportion of post-mortems conducted in Scotland is due to two factors:

1. In the past, necropsies have been performed on all condition 3 carcasses obtained in Scotland whilst in England and Wales only a proportion of condition 3 carcasses have a post mortem; and
2. Scotland has had a greater proportion of strandings associated with the 'other species' category (1997-2006 data: 57.8±8.2 in Scotland compared to 8.3±6.7 for England and Wales). Some of these are rare species for which post-mortems would be conducted regardless of where they stranded in the UK.

### 3.3.1 2007: Assessment of spatial and temporal distribution of post-mortems

An examination of the spatial distribution of strandings, IoZ indicated that 32 post-mortems should be allocated to Scotland and 68 to England and Wales if the proportion of post-mortems undertaken was to reflect the stranding data on a spatial basis. The data utilised for these calculations excluded carcasses for which the species could not be determined and covered the period 1997-2006. In line with the recommendation on a change in the ratio of species for which post-mortems are undertaken, the spatial distribution of post-mortems should be reflect reported strandings on a country basis. This, however, should use a 5 year rolling mean approach, similar to that used to assess the distribution of post mortems between species. For the period 2002-2006 spatial distribution of strandings would indicate the following allocations:

- Scotland – 25
- England – 55
- Wales – 20

Finer scale analysis of the stranding data revealed variations with respect to distribution of reported harbour porpoise strandings around the UK coastline on a monthly basis. Examining the data on rolling 5 year basis for area and month demonstrates a reasonably consistent occurrence of reports in particular locations at particular times of the year (Annex 1).

It was noted that there were consistently more harbour porpoises reported stranded in the southwest particularly over the winter months, whilst in Wales and west England, stranding reports more commonly occur over the summer months and in Scotland in the spring. Changing the allocation of post-mortems for harbour porpoises to 55-65 per year in total would indicate the following annual area allocations:

- Wales and English west coast: 19-24;
- Southwest England: 10-12;
- English Channel: 1-2;
- English east coast: 10-12; and
- Scotland: 12-15.

These could be further subdivided to give an indication of likely post-mortem requirements per month (Table 6). It should be noted that these are only indicative of the number of harbour porpoise post-mortems that are likely to occur throughout the year and are not to be considered exact requirements.

**Table 6: Allocation of post-mortems for harbour porpoise by area and month bases on 2002-2006 reported stranding data**

| Month | West Coast, Wales and England | Southwest England | English Channel | East coast, England | Scotland |
|---|---|---|---|---|---|
| January | 0-1 | 2-4 | 0-1 | 0-1 | 0-2 |
| February | 0-1 | 1-2 | 0-1 | 0-1 | 1-2 |
| March | 0-1 | 1-2 | 0-1 | 2-3 | 1-3 |
| April | 1-2 | 0-1 | 0-1 | 1-3 | 1-3 |
| May | 2-3 | 0-1 | 0-1 | 0-1 | 1-2 |
| June | 3-5 | 0-1 | 0-1 | 0-1 | 0-2 |
| July | 2-4 | 0-1 | 0-1 | 0-1 | 0-2 |
| August | 2-3 | 0-1 | 0-1 | 0-1 | 0-1 |
| September | 1-3 | 0-1 | 0-1 | 0-1 | 0-1 |
| October | 1-3 | 0-1 | 0-1 | 0-1 | 0-1 |
| November | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| December | 0-1 | 1-2 | 0-1 | 0-1 | 0-1 |
| Area allocation | 19-24 | 10-12 | 1-2 | 10-12 | 12-15 |

Similar analyses were undertaken for the common dolphin and 'other species' data to provide indicative post-mortem requirements by area and month. A total of 15-20 common dolphin post-mortems per year would lead to the following area allocations:

- Wales and English west coast: 0-1;
- Southwest England: 12-16;
- English Channel: 1-2;
- English east coast: 0-1; and
- Scotland: 0-1.

with indicative monthly post-mortem requirements given in Table 7. A total of 10-25 'other species' post-mortems would suggest the following area allocations:

- Wales and English west coast: 1-2;
- Southwest England: 1-4;
- English Channel: 0-1;
- English east coast: 1-3; and
- Scotland: 6-16.

with indicative monthly post-mortem requirements given in Table 8. The data presented in Tables 6-8 will aid more effective decision making on where and when to post-mortem, but should only be considered as a guide to likely occurrence and in no way should be considered to be exact requirements.

### 3.3.2 Review response & recommendation

In line with the recommendation on a change in the ratio of species for which post-mortems are undertaken, the spatial distribution of post-mortems should reflect reported strandings on a country basis. Using a 5 year rolling mean, the spatial

distribution of post mortems should be 25 to Scotland, 75 to England and Wales. This should be reviewed triannually inline with contract renewal.

**Table 7: Allocation of post-mortems for common dolphin by area and month based on 2002-2006 reported stranding data**

| Month | West Coast, Wales and England | Southwest England | English Channel | East coast, England | Scotland |
|---|---|---|---|---|---|
| January | 0-1 | 4-5 | 0-1 | 0-1 | 0-1 |
| February | 0-1 | 1-2 | 0-1 | 0-1 | 0-1 |
| March | 0-1 | 3-5 | 0-1 | 0-1 | 0-1 |
| April | 0-1 | 1-2 | 0-1 | 0-1 | 0-1 |
| May | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| June | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| July | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| August | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| September | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| October | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| November | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| December | 0-1 | 1-2 | 0-1 | 0-1 | 0-1 |
| Area allocation | 0-1 | 12-16 | 1-2 | 0-1 | 0-1 |

However, the data used for this analysis excluded all indeterminate species. Using all strandings, the spatial distribution is 24 to Scotland and 76 to England and Wales. Carcasses labelled as being of indeterminate species are either in such a poor condition that it is not possible to identify the species accurately or the species was not identified when the stranding was reported but the carcass is in a suitable condition for post-mortem. Of the cetaceans of indeterminate identity recorded between 2002 and 2006, only a minority would have been suitable for post-mortem examination (0% in Scotland, 14.6% in England and 5.3% in Wales). Consequently, in future, it is not considered necessary to include this latter grouping within the analyses to determine the spatial distribution of post-mortems on a country by country basis.

**Recommendation 3: From the current analysis, the spatial distribution of post-mortems should reflect that of the strandings (25 in Scotland and 75 in England and Wales). This should be reviewed triannually.**

**Recommendation 4: The carcasses sampling rationale should be subject to an annual review and included as an appendix in the annual report.**

**Table 8: Allocation of post-mortems for other species by area and month based on 2002-2006 reported stranding data**

| Month | West Coast, Wales and England | Southwest England | English Channel | East coast, England | Scotland |
|---|---|---|---|---|---|
| January | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| February | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| March | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| April | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| May | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| June | 0-1 | 0-1 | 0-1 | 0-1 | 1-2 |
| July | 0-1 | 0-1 | 0-1 | 0-1 | 1-2 |
| August | 0-1 | 0-1 | 0-1 | 0-1 | 1-2 |
| September | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| October | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| November | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| December | 0-1 | 0-1 | 0-1 | 0-1 | 1-2 |
| Area allocation | 1-2 | 1-4 | 0-1 | 1-3 | 6-16 |

## 4. Review Outcome: Web services – development and transition from current system

A core objective of the current contract period (2007-2010) is to

'*develop a specification for an integrated database which would bring together accurate and geo-referenced information on both strandings data and post-mortem data and would allow end users to interrogate this data using the internet*'.

Given the restrictions placed on the number of post-mortems that will be funded under this project, effective ways of publicising the project are required to ensure effective reporting of strandings and the generation of as much useful information as possible from each stranding event.

Under ASCOBANS there is an obligation to '*provide* [information] *to the general public in order to ensure support for the aims of the agreement in general and to facilitate the reporting of sightings and strandings in particular'*. As a minimum, the provision of data through a web portal, such as the NBN gateway, meets this obligation.

Three possible routes for delivery of a web based service were identified by IoZ, although option 1 is considered the minimum required, option 2 would represent the best route for the future development of CSIP. Details of the three delivery options are presented in summary in Table 9.

For all options, a data clean up process will be required that would deal with duplication and difficulties with existing data (e.g. use of both metric and imperial measurements, locations of stranding have been entered variously as grid references, lat/long or northings and eastings).

**Table 9: Summary of options for web-based services delivery**

| | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| **Database Development**[1] | • **No database development**; use existing database systems and a copy of the database made annually to DASSH | • Development of a **centralised database** incorporating IoZ, NHM, SAC, MEM data with access for entry and update of data via a web access point | • Development of a centralised database incorporating IoZ, NHM, SAC, MEM data with access for entry and update of data via a web access point. Also develop a GIS function of CSIP website to directly display data |
| **Web dissemination** | • Dissemination of strandings data via a web portal such as the **National Biodiversity Network (NBN) Gateway**<br>• **Simple dedicated UK strandings** Scheme website –**several linked pages** with: short outline of the UK Strandings Scheme; Contact details for reporting of stranded animals (in all countries); link to web portal for data & Welsh and Scottish websites (where they exist); and contact address for more information etc | • Dissemination of strandings data via a web portal such as the **National Biodiversity Network (NBN) Gateway** & potential link made to MAGIC Gateway<br>• **Dedicated UK strandings Scheme** website with: short outline of the UK Strandings Scheme; Contact details for reporting of stranded animals (in all countries); link to NBN for data & Welsh and Scottish websites (where they exist); information page (which includes pdf/links for reports and publications); species ID chart etc to aid data quality and collection; information on recent strandings of interest, cause of death category definitions etc; email updates through e.g. host@ukstrandings.org etc and contact address for more information etc for researchers etc<br>• Levels of access will be set (i.e. partners access/edit all, SG/DASSH etc access a proportion) | • As Option 2 plus;<br>• **Dissemination of strandings data on request via a specific GIS web application accessible through the CSIP website.** Links made from NBN gateway to this gateway. |

| | Option 1 | Option 2 | Option 3 |
|---|---|---|---|
| **Data to be disseminated through wen portal and/or CSIP GIS application (Option 3 only)** | National reference no.; Species; mass or single stranding; length; sex; age class; date found; location reference (inc. spatial co-ordinates); body condition; post mortem record available; cause of death category | National reference no.; Species; mass or single stranding; length; sex; age class; date found; location reference (inc. spatial co-ordinates); body condition; post mortem record available; cause of death category | National reference no.; Species; mass or single stranding; length; sex; age class; date found; location reference (inc. spatial co-ordinates); body condition; post mortem record available; cause of death category |
| **Benefits** | • Web dissemination: uses existing resources and will build on the NBN gateway for dissemination. Meets UK obligation for provision of public access to strandings data. | • Dedicated database to allow records to be easily drawn together and interpreted and direct gateway established to web portal<br>• Will ensure QA of datasets from both IoZ and NHM<br>• Will allow direct entry of data.<br>• Will allow faster response times to interpretation of data when requests made from Government. | |
| **Comments** | • Two data sets (strandings and post mortem) will need to be annually amalgamated prior to it being suitable for dissemination via web portal. Additional cost will be incurred for the amalgamation of data prior to the start of the current contract (i.e. pre 2007). This would be done in three time periods (post 2000, 1990-2000 and pre-1990) to allow progressive integration.<br>• IoZ to work with DASSH on appropriate protocol for transfer of data | • Two sets of data (strandings and post mortem) will need to be amalgamated and standardised prior to being incorporated into a single database. | • Not in keeping with the MDIP initiative to move towards centralised gateway for marine data access<br>• Over and above what is required to meet UK Obligations for ASCOBANS and the Habitats Directive |

[1]It is assumed that the centralised database would ideally include data on UK stranded cetaceans, marine turtles, basking sharks and seals, hence need to integrate data from all four partners.

## 4.1 Review response & recommendation

Option 1 is sufficient in order to the UK's obligations under ASCOBANS and the Habitats Directive and should be progressed in addition to the development of a strandings scheme web site. A well designed web site would act as the public face of the project, advertising the work undertaken by the project, aiding more efficient capture of data (e.g. stranded species pictures, species information to aid ID, email contacts through site etc), facilitating more efficient feedback of information (e.g. regular email updates from host@ukstrandings.org) and providing some qualitative information on strandings (e.g. descriptions of recent high profile strandings or interesting cases, links to reports on Defra site etc). A link to an existing web based portal (eg the NBN gateway) should also be included in the website thereby giving easy access to the strandings and post-mortem data.

Option 2, which includes development of a relational database for CSIP would be of benefit CSIP immensely (e.g immediate access to post-mortem reports for all stakeholders) and should be considered for the future development of CSIP. It is, however, not essential to enable the UK to meet its obligations.

**Recommendation 5**: **Use of an existing web portal gateway for the dissemination of the strandings and post-mortem data is recommended as the most cost-effective option for making information from the scheme publicly available, with links established to a CSIP dedicated website**

**Recommendation 6**: **Development of the domain www.ukstrandings.org is recommended to publicise the project and contact details. Further opportunities for dissemination of the project should also be encouraged**

## 5. Review Outcome: Implementation of volunteer network

Crane and Shepherd (2006) recommended that the contractor develop a detailed plan to establish volunteer networks across the UK similar to those operating in the south-west of England. The drivers for this were:

- Increased or more efficient reporting of strandings. It may be that there is some element of under reporting of strandings in some parts of the UK; and
- Reduction of post-mortem costs by using volunteers to assist with the data collection, tissue sampling, carcass retrieval etc thereby reducing the needs for transportation if a basic post-mortem could be conducted in situ.

The Crane and Shepherd (2006) report did not recognise that stranding networks do operate throughout the majority of the UK. Both representatives from Wales and Scotland believed that good networks of reporters operated in their areas. These networks are, however, not formally named as in the case of that in the south-west England. The main issue with respect to a network of stranding reporters for the current CSIP is the lack of coverage in some areas of UK coastline rather than the absence of a network outside of south-west England. For example, in recent years there has been an increase in harbour porpoise strandings across the Channel in Europe (ICES, 2007) that does not appear to have been reflected in such high numbers in the English data. It may be that strandings have not occurred or that stranded carcasses have not been reported.

When establishing volunteer networks a number of issues need to be thaken into consideration, including training, health and safety, necessary insurance and licensing. Annex 1 provides further details on these issues.

### 5.1 2007: Assessment of network arrangements

The gaps in the current network are thought in part to be related to relatively few strandings occurring in these areas. A volunteer network might be more difficult to maintain where there were few strandings to be dealt with. For example, experience in Australia demonstrated a gradual reduction in interest in a volunteer strandings network over a 10 year period until a mass stranding event occurred when membership surged. In contrast, in the Netherlands in the 1990s, a very efficient stranding network operated which probably found every Dutch stranding despite them being rare.

Implementation of a volunteer network with local ‘strandings reporters’ would ensure effective coverage of the UK coastline, that the majority of strandings were reported and that the information provided was accurate, particularly with respect to species and carcass condition.

### 5.1.2 Review response & recommendation

It was recommend that consideration be given to plugging the gaps in the current system and ensuring consistency in reporting standards possibly through the provision of training, rather than implementing a new UK wide system. Three possibilities have been identified:

- Conservation Agencies
- Expanding Wildlife Trust involvement.
- BDMLR/SeaWatch Foundation

1. Countryside Agencies

The Countryside Agencies are responsible for delivering nature conservation policy, providing advice and knowledge on nature conservation and for establishing common standards for monitoring and research in nature conservation. Natural England (NE), Scottish Natural Heritage (SNH) and Countryside Council for Wales (CCW) generally undertake monitoring whilst the Joint Nature Conservation Committee (JNCC) may collate the information when needed at the UK level and report to Defra.

Increasing the Countryside Agency participation in CSIP is not perceived as an onerous task. Accurate species identification and carcasses condition are considered the main needs. With the use of camera phones and other such digital technology it may not be necessary for the officer to actually see the carcass to enable identification of species and condition. Using a 5 year mean the indicative annual number of strandings by country are:

- England: 418.8 ± 63.9
- Wales: 135.4 ± 8.6
- Scotland: 172.8 ± 37.4

These numbers equate to approximately 9 carcasses per year per area office for England, 10 for Wales and 5 for Scotland. It should be noted that some offices will be involved to a greater extent than others depending on their location in relation to the coast and location of strandings.

2. Wildlife Trusts

The Cornwall Wildlife Trust (CWT) Marine Strandings Network (MSN) which operates in south-west England, was considered the best example of a volunteer network in the UK by Crane and Shepherd (2006). It has 7 core personnel and 120+ volunteers, with much of the costs associated with training, transport of carcasses, literature to publicise the stranding hotline number, web site maintenance etc being borne by the volunteers. The success of MSN relies on a team of people with the time and expertise to mange the work on a voluntary basis. In response to the Crane and Shepherd (2006), CWT indicated that the review failed to take into account the logistics and cost implications of such a network. Establishing and managing the MSN requires a large human resource input. Other issues identified include Health and Safety implications for the handling and transport of carcasses and the costs of insurance for such work.

Currently, CWT employs a Marine Conservation Officer who spends one third of their time on MSN. For the purposes of this review, CWT MSN provided an estimate of the costs associated with the set up and maintenance of their stranding network:

- Essential set up costs (one off costs essential to running of scheme): £7,350
- Additional set up costs (items beneficial to scheme): £900
- Ongoing costs per annum (includes costs for 1.3 members of staff): £40,345
- Volunteer time (included as an estimate of the time put into the project): £21,000

£69,595

CWT have indicated that they would like to see trained individuals around the country, particularly where strandings are less frequent and have agreed to help liaise with other coastal based Wildlife Trusts for such a provision. CWT have suggested that attending strandings to provide basic key information such as species and condition, could potential become part of the Wildlife Trust Officers role.

3. BDMLR/SeaWatch Foundation

British Divers Marine Life Rescue (BDMLR) are already involved in live strandings when they occur. Initial contacts with them indicate that they would be interested in expanding this to cover carcasses.

The SeaWatch Foundation (hereafter referred to as SeaWatch) maintains the national cetacean sightings database. SeaWatch has a number of locally based groups that undertake regular sightings surveys. Many of the Seawatch volunteers are already actively involved in reporting strandings.

Both organisations already have a UK-wide presence that would aid the implementation of a UK network.

To date, IoZ have initiated discussions with the Wildlife Trusts, BDMLR and Seawatch on extending the volunteer network. It is thought that, for example, SeaWatch could help with more efficient and accurate reporting of strandings particularly on the east coast and the English Channel. BDMLR volunteers may be able to help with carcass retrieval as they already receive training in handling marine mammals and have their own insurance (although this operates with respect to live rather than dead animals). It should be noted that although the BDMLR medics have received training, many have relatively little experience.

The putative database/web interface would also be an extremely useful tool in maintaining volunteer interest in the CSIP. The contractors could aim to provide regular (e.g. monthly) email updates on the work of the project (e.g. interesting strandings etc, reports published by Defra) to a volunteer mailing list and could also aim to hold a volunteer/stranding conference as a means of providing feedback and maintaining interest in the project.

**Recommendation 7: Defra, the Devolved Administrations and JNCC should encourage participation of the Countryside Agencies in the strandings scheme given their responsibilities for delivering conservation policy.**

**Recommendation 8: The Wildlife Trusts and other appropriate organisations should be approached by the contractors to enhance coverage of the UK coastline with respect to 'stranding reporters'. Mechanisms should also be put in place to ensure accuracy and consistency of reporting standards through, for example, the development of appropriate training schemes**

## 6. Review Recommendations

Recommendations arising from the review are as follows:

1. The limit on the number of post-mortems undertaken should remain capped at 100 per year. This should be reviewed triannually (in line with contract renewal) and any adjustments subjected to appropriate statistical analysis;
2. Rather than a specified total number of post mortems per species category, a range is recommended to allow flexibility and to enable spatial and temporal variations to be taken into account. The recommended annual ranges for post-mortems are 55-65 harbour porpoise, 15-20 common dolphins and 10-25 other species, with a maximum of 100 post-mortems in any one year. The proportion of post-mortems undertaken on the three species categories should be altered using strandings data on a five yearly rolling basis whilst maintaining statistical power. These numbers should be reviewed triannually with any adjustments subject to statistical analysis;
3. Using a 5 year rolling mean, the spatial distribution of post-mortems should reflect that of the strandings (25 in Scotland and 75 in England and Wales). This should be reviewed triannually;
4. The carcasses sampling rationale should be subject to an annual review and included as an appendix in the annual report;
5. Use of an existing web portal gateway for the dissemination of the strandings and post-mortem data is recommended as the most cost-effective option for making information from the scheme publicly available, with links established to a CSIP dedicated website;
6. Development of the domain www.ukstrandings.org is recommended to publicise the project and contact details. Further opportunities for dissemination of the project should also be encouraged;
7. Defra, the Devolved Administrations and JNCC should encourage participation of the Countryside Agencies in the strandings scheme given their responsibilities for delivering conservation policy;
8. The Wildlife Trusts and other appropriate organisations should be approached by the contractors to enhance coverage of the UK coastline with respect to ‘stranding reporters’. Mechanisms should also be put in place to ensure accuracy and consistency of reporting standards through, for example, the development of appropriate training schemes.

## 7. References


Bennett, P.M., Jepson, P.D., Law, R.J., Jones, B.R., Kuiken, T., Baker, J.R., Rogan, E. & Kirkwood, J.K., 2001. Exposure to heavy metals and infectious disease mortality in harbour porpoises from Engl;and and Wales. Environmental Pollution, 112, 33-40.

Cohen, J., 1988. *Statistical Power Analysis for the Behavioural Sciences*. Lawrence Erlbaum Associates, London.

Crane, M. & Shepherd, B., 2006. A review of the requirements and funding arrangements for research into cetacean stranding. Crown Copyright. Available at: http://www.defra.gov.uk/wildlife-countryside/resprog/findings/cetaceanstrand-review/ cetaceanstrand-review.pdf

Hall, A.J., Hugunin, K., Deaville, R., Law, R.J., Allchin, C.R., Jepson, P.D., 2006. The risk of infection from polychlorinated biphenyl exposure in harbour porpoise (*Phocoena phocoena*) – a case-control approach. *Environmental Health Perspectives*, **114**, 704-711.

ICES, 2007. Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2007. Book 1 Introduction, Overviews and Special Requests. Section 1.5.1.2 Status of small cetaceans and bycatch in European Waters. Available at: http://www.ices.dk/committe/ acfm /comwork/report/2007/ace%20advice/Marine%20Mammals.pdf

Jepson, P.D. (Ed), 2006. *Trends in cetacean strandings around the UK coastline and cetacean and marine turtle post-mortem investigations, 2000 to 2004 inclusive.* Defra Contract CRO 238. Available at: http://www.defra.gov.uk/wildlife-countryside/resprog/findings /cetacean05/cetstrand0005-full.pdf

Jepson, P.D., Arbelo, M., Deaville, R., Patterson, I.A.R., Castro, P., Baker, J.R., Degollada, E., Ross, H.M., Hereraez, P., Pocknell, A.M., Rodriguez, E., Howie, F.E., Espinosa, A., Reid, R.J., Jaber, J.R., Martin, V., Cunningham, A.A. & Fernandez, A., 3003. Gas-bubble lesions in stranded cetaceans. *Nature*, **425**, 575-576.

Jepson, P.D., Bennett, P.M., Allchin, C.R., Law, R.J., Kuiken, T., Baker, J.R., Rogan, E. & Kirkwood, J.K., 1999. Investigating potential associations between chronic exposure to polychlorinated biphenyls and infectious disease mortality in harbour porpoises from England and Wales. *The Science of the Total Environment*, **243/244**, 339-348.

Jepson, P.D., Bennett, P.M., Deaville, R., Allchin, C.R., Baker, J.R. & Law, R.J., 2005a. Relationships between PCBs and health status in UK-stranded harbour porpoises (*Phocoena phocoena*). *Environmental Toxicology and Chemistry*, **24**, 238-248.

Jepson, P.D., Deaville, R., Patterson, I.A.R., Pocknell, A.M., Ross, H.M., Baker, J.R., Howie, F.E., Reid, R.J., Colloff, A. & Cunningham, A.A., 2005b. Acute and chronic gas bubble lesions in cetaceans stranded in the United Kingdom. *Veterinary Pathology*, **42**, 291-305.

Kuiken, T., Simpson, V.C., Allchin, C.R., Bennett, P.M., Codd, G.A., Harris, E.A., Howes, G.J., Kennedy, S., Kirkwood, J.K., Merrett, N.R. & Phillips, S., 1994. Mass mortality of common dolphins (*Delphius delphis*) in south west England due to incidental capture in fishing gear. *Veterinary Record*, **134**, 81-89.

Murphy, K.R. & Myors, B., 2004. *Statistical Power Analysis. A simple guide and general model for traditional and modern hypothesis tests*. Lawrence Erlbaum Associates, London.
Nichols, J.D. & Williams, B.K., 2006. Monitoring for conservation. *Trends in Ecology and Evolution*, **21** (12), 668-673.

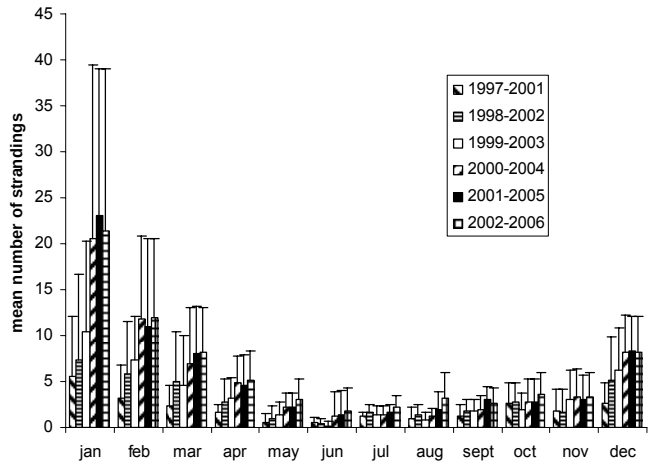
## ANNEXES

ANNEX 1: Spatial and temporal distribution of harbour porpoise reported stranding on a 5 yearly rolling basis between 1997 and 2006.

ANNEX 2: Considerations for establishing volunteer networks

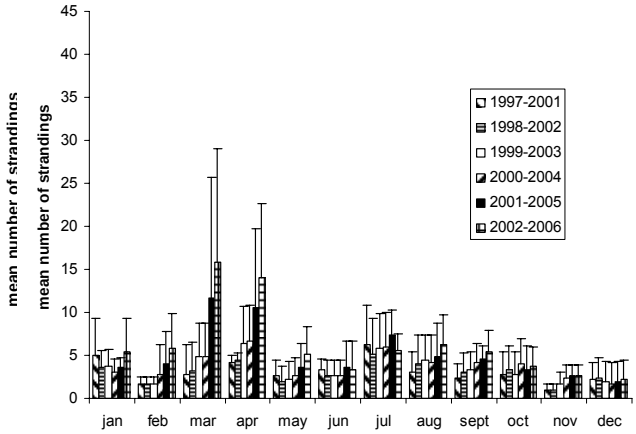
## ANNEX 1: Spatial and temporal distribution of harbour porpoise reported stranding on a 5 yearly rolling basis between 1997 and 2006.

A. West coast , Wales and England



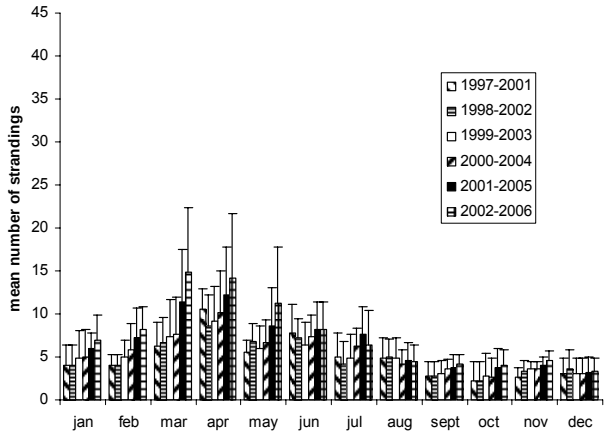

B. Southwest England

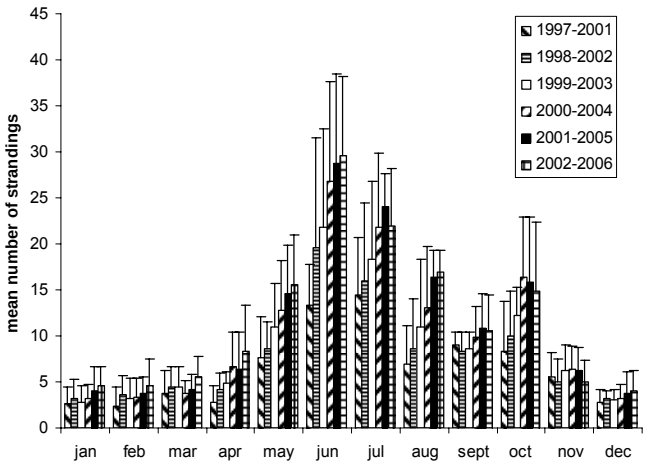
C. English Channel




D. East Coast, England

E. Scotland



## ANNEX 2: Considerations for establishing volunteer networks

**Training**: Recently, there have been several occasions when the species or carcass condition have been misreported which has lead to either the loss of a specimen for which a post-mortem would have been performed had it been correctly identified (e.g. a pygmy sperm whale was misidentified as a white-sided dolphin) and/or unnecessary travel time and expenses were incurred (e.g. when staff have arrived to collect a carcass described as very fresh, it has turned out to be condition 3). The development of a series of local stranding reporters for which basic training could be provided would help to reduce such misreporting and ensure consistent standards across the UK. BDMLR and CWT already have training schemes in place that, with some slight adaptations and/or additions could be used as a basis for training stranding reporters.

**Health and Safety**: There are implications for the handling and transport of carcasses such as the spread of disease and infection. SAC clearly stated that formal arrangements would be very difficult to put in place due to H&S issues in organisations which have no experience or expertise in the retrieval of carcasses from beaches. In their opinion such work could only be carried out safely by experienced personnel. Both IoZ and SAC are very careful never to ask a member of the public to collect samples from dead cetaceans due to Health and Safety implications. At most they will ask for someone to secure a carcass by either tying it to something or if it is small enough then dragging it above the high water mark. When asking for such assistance they always emphasise the use of gloves or plastic bags over the hands.

**Insurance**: Needs to cover aspects such as individuals handling and transporting carcasses. This is extremely expensive. BDMLR have their own insurance and also have basic training in the handling of marine mammals.

**Licences**: Under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) a licence will be required to possess or transport dead specimens and/or derivatives of cetaceans in England and Wales. NE and CCW are currently in the process of preparing guidelines for these licences. IoZ will be issued with a single licence to cover all necropsies/samples but it is unclear whether this licence will be applicable to volunteers working for them or if each organisation involved will require their own licence. Similar requirements exist in Scotland under the Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007.

**Equipment**: The provision of equipment such as trailers, bags and other consumables needs to be considered as well as issues regarding clean up and disinfection of equipment after use