Common Standards Monitoring Guidance

for

Marine Mammals

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UK Common Standards Monitoring Guidance for Marine Mammals

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1 Introduction

The introduction to the guidance manual on Common Standards Monitoring (CSM) of designated sites adopted by the statutory nature conservation agencies covers the various concepts, terms and background on setting conservation objectives, and assessing feature condition. It also covers the requirement to record threats and management practices as part of the monitoring process in order to relate observed changes in the condition of the interest features to the reasons for such changes.

It follows that there must be a close link between management planning and monitoring. For any particular site, each of the individual interest features should be monitored ideally within the same year, and certainly within a three-year period. The minimum standard is to monitor each feature once every six years. This does not preclude more frequent monitoring if the ecological needs of the feature justify it.

If condition monitoring is only undertaken once every six years under CSM, this needs to be supplemented by compliance monitoring (to assess whether agreed management prescriptions are being followed), and possibly more frequent assessments on problematic or priority sites. Where the reasons for an unfavourable assessment are unclear, or the appropriate management response is unknown, there may be a need for further, more detailed survey, surveillance, monitoring or research activities.

The establishment of common standards enables comparable assessments made by different people and aggregation of results between different sites and at various geographical levels. It does not mean than monitoring must be undertaken using prescriptive and rigidly applied procedures. The approach needs to be flexible to take into account natural geographical variation across the UK and to accommodate the varying requirements and operational practices of the country agencies.

This section provides generic advice on selection of attributes and the process of assessing the condition of marine mammals on SACs and SSSIs/ASSIs. The elements of population dynamics, range, habitat extent and quality are important. Current thinking is reflected here but this may develop further as our experience of site-based monitoring increases.

Marine Mammals can be divided into two groups in UK waters: whales, dolphins and porpoises (collectively known as cetaceans) and seals (pinnipeds). Twenty five species of cetacean occur in UK waters, although many only rarely, and two species of pinniped with several other species occurring very rarely. This guidance covers the following species in particular:

- Grey seal *Halichoerus grypus*
- Harbour seal (also known as common seal) *Phoca vitulina*
- Bottlenose dolphin *Tursiops truncatus*

Currently, consideration is also being given to the inclusion of the harbour porpoise (*Phocoena phocoena*). Should protected sites be designated, then guidance for this species will also be incorporated.

2 Setting objectives and judging favourable condition

2.1 Selecting attributes and setting targets

Setting objectives and judging condition requires a clear knowledge and understanding of the conservation interest of the feature at a site. Such information should be drawn from previous surveys and local expert knowledge of the site, together with generic information on trends and/or natural variability in the state of feature gathered from the wider literature.

A condition assessment of marine mammal interest features[1] should be based on the attributes[2] and their associated targets derived from the generic attributes table found in each feature section.

Specific guidance for assessing the status of attributes of each interest feature is provided in the subsequent sections. For each interest feature the specific guidance identifies a core set of attributes which must be used to define favourable condition on every site, plus examples of additional attributes (site-specific) from which some or all can be used to highlight any local distinctiveness. Guidance on setting targets and available methodologies is also available. At this time, it is not possible to provide explicit guidance on the exact methodologies to be used since most are under development; the precise techniques to be used will be subject to specialist advice at the time of assessment. The following generic text should be read in conjunction with the specific feature guidance as it provides an introduction to issues that need to be initially considered when setting objectives and selecting attributes to define favourable condition, and advice on judging condition following the monitoring activities.

The present section provides generic advice on the selection of attributes and the assessment process for marine species features. This text has been taken from the introductory text to the common standards guidance, and is repeated here to emphasise the basic approach to be adopted:

> *There are specific problems associated with defining favourable condition for species interest features, and in particular whether condition should be assessed by direct means (e.g. measures of species population size) or indirect means (e.g. extent/condition of suitable habitat).*
>
> *The solution is to use a combination of approaches, tailored to the particular interest feature. The following principles have been applied:*
>
> - *In general, conservation objectives for species interest features should include assessments of the species population and assessments of habitat extent/quality.*
> - *Quantitative assessments of population size should only be used when:*
>   i. *the species population can be counted or measured reliably, e.g. most birds, some vascular plants; and*

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[1] The Common Standards text defines an interest feature as: *a habitat, habitat matrix, geomorphological or geological exposure, a species or species community or assemblage which is the reason for notification of the site under the appropriate selection guidelines or, in the case of Natura 2000 and Ramsar areas, the features for which the site will be designated.*

[2] The Common Standards text defines an attribute as: a *characteristic of a habitat, biotope, community or population of a species which most economically provides an indication of the condition of the interest feature to which it applies*

ii. meaningful targets can be set which take population fluctuations into account.

- *Where quantitative assessments cannot be used, conservation objectives should generally incorporate species presence/absence, i.e. for an interest feature to be in favourable condition the species should usually be recorded at least once during a 6-year reporting cycle.*
- *Some habitat attributes should generally be used, provided the habitat requirements of the species are broadly known – if necessary, further work should be undertaken to establish this.*

2.1.1 Selecting attributes

The aim of the attribute selection process is to produce a focussed and prioritised list of attributes for the feature that will most efficiently define its expected condition at a site.

To assist the initial selection process, any attribute must:

- help to define condition;
- be capable of clearly identifying a change in condition;
- be measurable, and;
- be capable of being monitored practically and economically.

Priority should be given to attributes that:

- also indicate a likely anthropogenic pressure that may affect the feature's condition
- provide information to more than one component of the management regime – e.g. where a measurement could provide data to be used both to assess the feature's condition and assess compliance with a management action (possibly by another regulatory authority)
- provide as much information about the feature as a whole as possible
- have a baseline already adequately quantified
- are already measured at the site, e.g. by another regulatory authority as part of a compliance monitoring programme
- are more readily measured, technically and/or cheaply, than alternative attributes providing similar information, e.g. species that are more easily identified than other species, or
- contribute to other nature conservation initiatives such as BAP.

In refining any list of attributes also note:

- The need to avoid duplication between attributes.
- Selecting a combination of attributes some of which are to be measured both in the short-term and some in the long-term may collectively provide more valuable information than several attributes that are all measured only once during a reporting cycle.

As further information is gathered about features and more experience gained on the assessment process, it is possible that the list of attributes will be refined to incorporate measures that are more informative or cost effective.

A target state should be defined for each attribute specifically selected for the feature on a given site. While the list of possible attributes that could be selected are generic across all features on all sites the targets are, and must be, site-specific to highlight local distinctiveness. Therefore, while examples of targets that might be set are given, these are for illustrative guidance only. Conservation agency staff must define a target condition as appropriate to their sites, based on local knowledge and information normally gathered from the site or its immediate environs.

It is important to note that not all attributes may be applicable to all parts of a feature at any one time, particularly in larger sites. Before undertaking condition assessment, the applicability of attributes and targets to the whole site, or just a few restricted areas should be considered and tailored accordingly. For example, if a *disturbance* attribute is used for a specific relatively small area within a large bay, then this attribute is specific to that area and not necessarily the entire system. Nevertheless, if the disturbance attribute does not meet the target condition, the whole feature will be classed as unfavourable.

2.1.2 Setting a target

A target is intended to reflect the condition of the feature that we wish to achieve on that designated site, not the management system or operations that lead to that condition. A target may be a single threshold (upper or lower) beyond which condition is judged unfavourable. Alternatively a target may be defined as a range within which fluctuations may occur. For example, the target for the availability of suitable sandbank haul-out sites for common seals may require that only a proportion of the total likely area of sediment is present at any one time, accepting a degree of cyclical change in the appearance/disappearance of mobile sandbanks.

It is important to remember that the target/target range represents a threshold that should be considered a trigger for further action. When an attribute fails to meet the target condition for a feature, this will require further investigation to ascertain if any management response is needed to ensure the feature returns to favourable condition at future date.

2.1.3 Summary

A summary of the approach used to define favourable condition for an interest feature is as follows:

- identify the attributes for the interest feature which are considered on best judgement, to be essential to assess its condition; and
- set site specific targets for those attributes

These aggregated targets then provide the evidence from which we judge favourable condition for the entire feature on a site.

2.2 Assessment process

It is important to note that the process of condition assessment of marine features is an almost entirely new activity within the conservation agencies at this time (Spring 2005). There is limited experience to draw upon to develop unambiguous guidance on condition assessment and thus it will be necessary to apply a high level of expert judgement during the next few years.

For many marine attributes, there are insufficient data to establish certain, unambiguous target conditions. In particular, there are insufficient time series studies to fully assess the extent of the underlying background variation (due to environmental and/or biological factors) against which the magnitude of an impact from a known anthropogenic pressure may be judged. It is anticipated that the certainty of target conditions will increase over future monitoring cycles, and with additional data gathered from surveillance programmes.

The basic philosophy for judging whether a feature on a site is at favourable condition is that all the attributes are judged to be favourable. That is, failure of any one attribute to meet its target condition at the end of the assessment process dictates that the whole feature should be classed as unfavourable. For features subject to change, it may be appropriate to use expert judgement to determine each attribute's relative contribution to the overall assessment in relation to the specific conservation interest of the feature at that site

Consequently, there are two distinct phases in the assessment process: a field assessment followed by a reporting phase. The two phases comprise:

1. **Field Assessment**: Information gathering (from field work & other reviews) to assess the status of an attribute against the target condition to give its 'field status'. This stage can include a review and possible revision of the target condition where there is uncertainty over the validity of the current target, particularly where information from more contemporary studies suggests the original target may be incorrect. Such a revision should help reduce the uncertainty around a target condition. At the end of this stage the attribute condition is aggregated to ascertain the basic condition of the feature as a whole, the "field status", as either favourable or unfavourable. This should be based on the worst attribute assessment or the "default" approach. This process is outlined in figure 1. It is important that all information and decisions are documented.

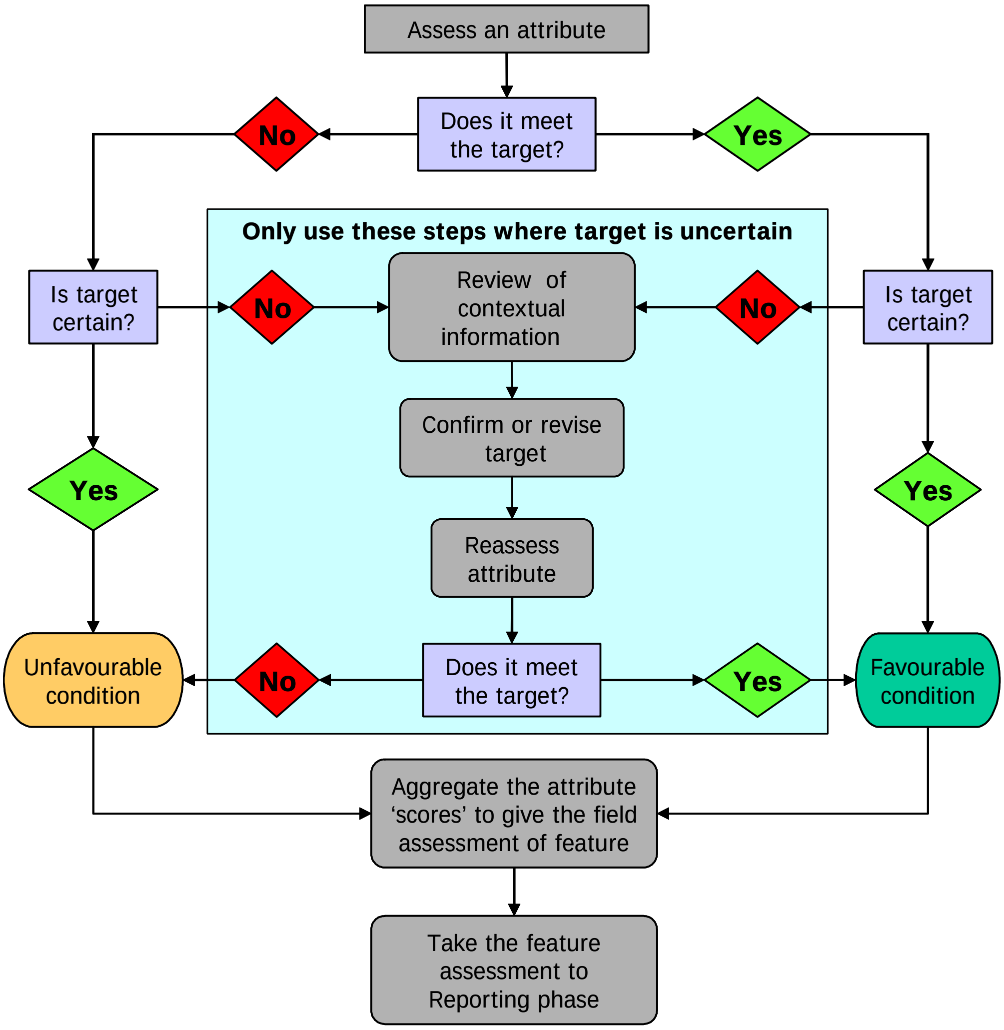

Figure 1: A suggested decision process to assess the field status of a feature. This field assessment step should be repeated for all attributes that define feature condition.

2. **Reporting**: This next stage takes the process further, whereby the 'field status' is reviewed against previous assessments to identify any trend, and/or other information gathered to identify the source of any unfavourable condition to initiate an appropriate management response if necessary. If the reason for judging the field status as unfavourable is clearly demonstrated to be due to natural events adversely influencing one or more attributes, the feature could be declared favourable where the officer is certain that the conservation interest of the feature is not compromised. If one or more attributes were judged unfavourable due to anthropogenic factors then the feature would be declared unfavourable. Once these stages are completed, a final assessment may be completed to establish the 'reporting status'. This process is outlined in figure 2.

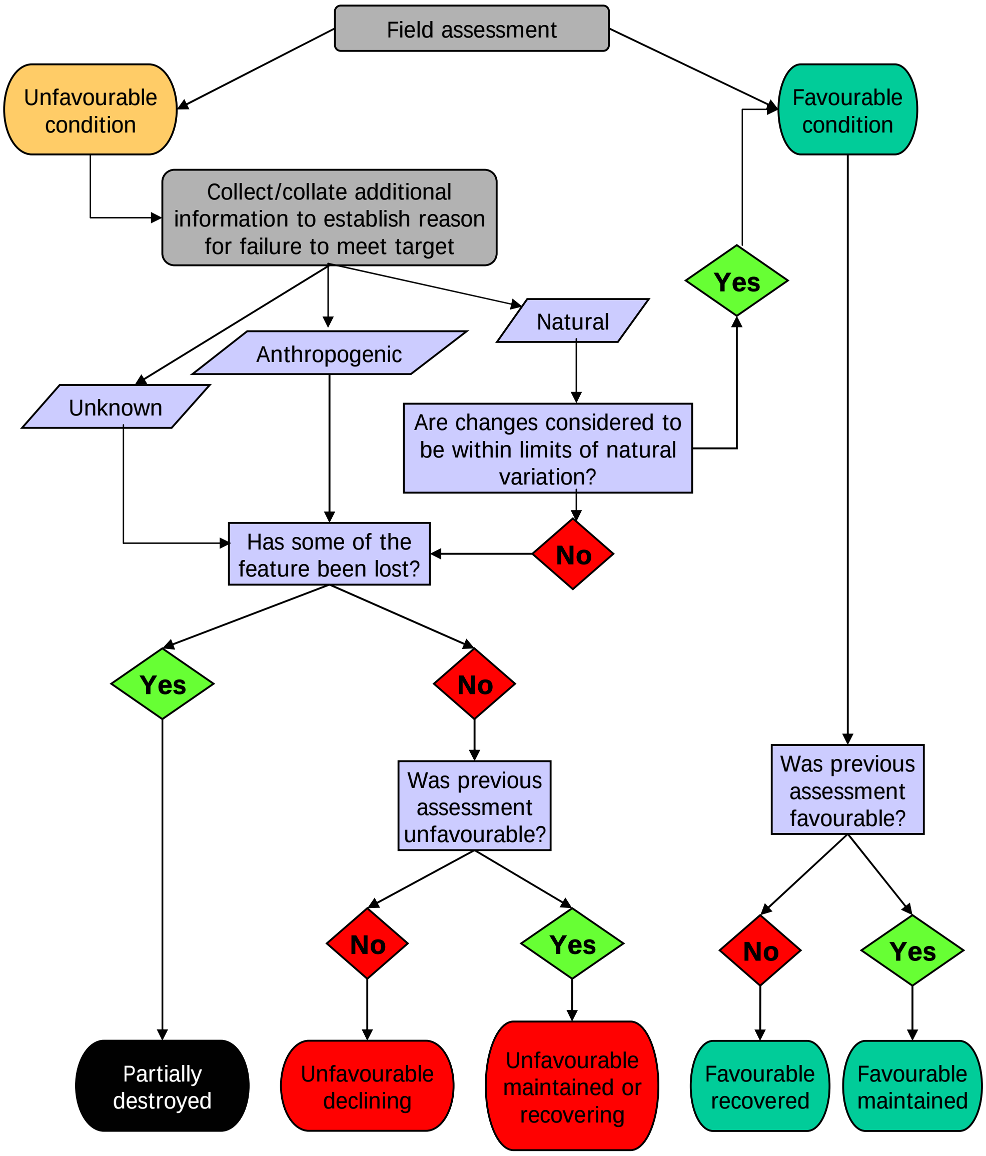

Figure 2: A suggested decision process to determine the status of the interest feature for reporting.

The reporting phase may take a number of years depending upon the timing of the field studies for the data assessment in the overall six-year reporting cycle. A number of distinct activities are anticipated:

1. Where the field status is deemed *favourable*, the current status should be compared with the previous assessment to establish whether there is any evidence of a trend in the feature's condition. For the first assessment, the current condition should be compared to the most recent information available from other field studies at the site (such as a baseline survey) to determine whether there is any change in the condition. For example, a feature was known to be subject to an adverse anthropogenic activity prior to notification/designation and would have most likely been considered in

unfavourable condition. Management action after notification reduced the level of the adverse activity and at the time of the first monitoring cycle the feature was judged as *favourable,* it should be reported as *favourable recovered.*

2. Where the field status is deemed *unfavourable*, additional information must be gathered to determine the likely cause of the failure and to determine any subsequent management action.
3. Expert judgement must be applied to determine whether the ‘default approach’ to aggregating the judgements on multiple attributes to give a feature assessment (i.e. one attribute is deemed unfavourable so the entire feature is unfavourable) applies.
4. Where the cause of an *unfavourable* field assessment is linked to a known anthropogenic pressure and appropriate management action has been established with evidence of recovery in the feature’s condition, the feature should be reported as *unfavourable recovering*.
5. Where the cause of an *unfavourable* field assessment is clearly attributable to an extreme natural event, or a natural dynamic process including climate change, the final assessment will require expert judgement to determine the reported condition. Where there is evidence of recovery towards the target condition following an extreme event, the feature should be reported as *unfavourable recovering.*
6. Assessing the final status of a feature when an attribute was deemed *unfavourable* due to a natural dynamic process will be more complex and it difficult to give clear, unambiguous guidance at this time. Where a target condition was predicted, for example using a theoretical model, the current ‘*unfavourable’* condition might be a function of an imprecise prediction due to a lack of data. Reviewing the target condition in the light of new information will enable the final assessment and it may even lead to the attribute (and the feature) being judged *favourable*.
7. Where the field status is deemed *unfavourable* and there is a clear loss of the conservation interest from the feature and no hope of its recovery, the feature should be reported as *partially destroyed*.

2.3 Contextual information

The interpretation of evidence from the condition monitoring activity may require access to contextual information, perhaps from a wider geographical area, or over longer time scales. It is important to ascertain that an observed change is a local phenomenon resulting from an activity on a site, and not inherent variability or a nation-wide trend caused by some other factor. Although condition assessment will look at the attributes derived from the tables listed under each feature, in some cases these may be difficult to interpret without some evidence on supporting processes.

Contextual information on factors and other biological surveillance programmes will increase our confidence in the attributes we have identified, confirm that the targets we have set are appropriate and take full account of natural variation. It will also allow us to compare site based trends with national trends, to allow us to understand changes and ensure consistency of judgements at the national level.

2.4 Health and safety

All fieldwork must follow approved codes of practice to ensure the health and safety of all staff. Risks specific to working with Annex II species are detailed in the Marine Monitoring Handbook (Davies et al., 2001).

3 Background to grey seal *Halichoerus grypus* feature, background, targets and monitoring techniques for individual attributes

3.1 Background to grey seal (Halichoerus grypus) *feature*

Figure 3: Grey seal *Halichoerus grypus* (Paddy Pomeroy, SMRU).

The UK populations of grey seals, *Halichoerus grypus* Fabricus, represent about 40% of the global population and 95% of the EU population (Davies et al., 2001; Moore 2003; SCOS, 2003). It is estimated that there are approximately 120,000 grey seals in UK waters (annual updates in SCOS documents at www.smru.st-and.ac.uk). In Britain, over 90% grey seals breed in Scotland, the majority in the Hebrides and Orkney Islands (SCOS, 2003; Moore, 2003).

The grey seal is the larger of the two resident species in the UK. Grey seals exhibit size dimorphism, with males being larger than females (King, 1984). Males can reach 2.3m long and weigh 350kg, whilst females reach 2.0m in length and weigh 250kg (SCOS, 2003). In addition, however, their weight varies over the year as they move between periods of fasting associated with moulting and breeding followed by foraging at sea (Beck et al., 2003). Grey seals are a long lived species, over 20 years for males and 30 years for females (SCOS, 2003). The distribution of this seal species is affected by its life cycle, climatic conditions, availability of food and access to haul-out sites.

Seven cSACs have been proposed specifically for grey seals, selected on the basis of pup production and geographic range. These are Berwickshire and the north Northumberland coast (including the Farne Islands), the Isle of May (Firth of Forth), Faray and Holm of Faray (Orkney), the Monach Isles and North Rona (Scottish Western Isles), Treshnish Isles (Argyll and Bute) and Pembrokeshire Marine (south west Wales). An additional four cSACs also list grey seals as a qualifying feature but not the primary reason for selection. These are Cardigan

Bay, Lleyn Peninsula and the Sarnau, Lundy Island, and the Isles of Silly. In addition, grey seals may also be listed as a qualifying feature in some coastal SSSIs and/or ASSIs.

Habitat requirements

Grey seals feed at sea but require haul-out areas on land to rest, moult and give birth to and raise their pups. In general, haul-out sites are relatively undisturbed and can be on rocks, sandbanks or on shingle (Pomeroy et al., 2000). They appear to prefer to remain very close to the waters edge, moving up or down with the tide. Haul-out sites are frequently at the extreme points of islands or coasts which give good access to the open sea. Numbers at haul-out sites can vary from single animals to groups of up to approximately 2,000. Haul-out sites for moulting can be the same as resting sites, though seals might be found slightly further from the water's edge. Grey seals form breeding aggregations at traditional, remote colonies (Amos et al., 1993), with females often returning to the same location on the breeding colony to give birth to their single pups (Boness & James, 1979; Twiss et al., 1994; Pomeroy et al., 2000). In addition, some females exhibit philopatry, i.e. returning to breed at their natal site (Redman et al, 2001). During the breeding season, grey seals are not restricted to beaches. Where there is suitable habitat, females can move some distance from the sea, especially where they have access to pools of water (Ambs et al., 1999). They may move with their pups, or give birth, inland.

Movement, foraging and diet

The movement of grey seals has been extensively studied in the North Sea and around Scotland using satellite telemetry (e.g. McConnell et al., 1999, 2004). Satellite transmitters are attached to the back of a seal's head using fast-setting epoxy resin and remain on the seal until the next moult. Transmitters have been deployed on grey seals at numerous locations around the UK coast, including the Farne Islands, the Monach Isles, Orkney, Shetland, the Firth of Forth (the Isle of May), the Firth of Tay, the Moray Firth, Oronsay in the Inner Hebrides and in a number of locations in west Wales. McConnell et al. (1999) found movements were on two geographic scales: long and distant travel (up to 2100km away) and local repeated trips to discrete offshore areas. The distances travelled indicated that grey seals that haul out in the Farne Islands are not ecologically isolated from those at the Firth of Forth, Firth of Tay, Orkney, Shetland and the Faroes.

Grey seals are predominantly opportunistic fish feeders and, consequently, their diet varies with season and location. Prey species include sandeels (up to 50% of diet), as well as gadoids (e.g. saithe, cod) and flatfish; salmonids, cephalopod and crustacean invertebrates are occasionally consumed (Hammond & Prime, 1990; Prime & Hammond, 1990; Thompson et al., 1991; Murie & Lavigne, 1992; Bowen et al., 1993; Hammond et al., 1994a, 1994b; Hall & Walton, 1999; Mikkelsen et al., 2002). Grey seals can forage widely, with most individual seals returning to the same haul-out site from which they departed. In the North Sea, the durations of these return trips were short (typically 2-3 days) and their destinations at sea were often localized areas characterized by a seabed of gravel/sand, ideal sandeel habitat, within 40km of the haul-out site (McConnell et al., 1999).

Monitoring the condition of attributes in relation to foraging area and prey availability will be difficult for grey seals because of their mobility and ability to switch between prey species. However, such studies are important for management of seal colonies and fish stocks and may be necessary as part of compliance monitoring on a site to site basis. To achieve this effectively, considerably more information on the foraging distribution of grey seals around the UK is required.

Reproduction

Approximately 40% of the world population of grey seals breed at UK sites, representing 95% of the EC population. Grey seals normally breed on exposed rocky coasts and in caves (Baines *et al* 1995; Pomeroy et al., 2000). Breeding colonies can be found all round the British coast, although over 90% of breeding occurs in Scotland, with the majority of breeding sites in the Hebrides and Orkney (SCOS, 2003).

Males begin breeding at approximately 10 years old, whilst females breed from the age of 5. Grey seals form polygynous breeding groups but the size of the groups and the sex ratio varies with the nature of the habitat (Ambs et al., 1999; Pomeroy et al., 2000). In addition, genetic analyses have revealed that 35-70% of pups were not fathered by the consort male suggesting that aquatic mating plays a relatively important role in this species (Amos et al., 1993; Ambs et al. 1999; Wilmer et al., 1999).

The timing of breeding varies, getting progressively later in colonies distributed clockwise round the British coast. Thus pups are born from August to October in south west Britain, from mid September to mid November in west and north Scotland, from mid October to early December at the Isle of May (Firth of Forth) and the Farne Islands, while at Donna Nook (Lincolnshire), pups are born primarily in November and December.

Breeding females in the UK are generally associated with areas close to numerous access points from the sea and/or standing water and at low elevations (Pomeroy et al., 2000; Twiss et al., 2002). Female grey seals give birth to a single white-coated pup, which is weaned and moults in 17 to 21 days (Hewer, 1960; Fogden, 1971). Towards the end of lactation, the females come into oestrus and mating occurs. Soon after mating the females leave the breeding colony, resulting in an abrupt weaning of the pups, with no parental care thereafter (Hewer, 1960; Fogden, 1971). Most females return to the same site to breed, with site fidelity persisting even when a previous pupping has been unsuccessful (Pomeroy et al., 1994, 2000).

Current Monitoring Programmes

Under the Conservation of Seals Act 1970, the Natural Environment Research Council (NERC) has a statutory obligation to provide the UK Government with advice on the size and status of British seal populations. NERC's Sea Mammal Research Unit (SMRU) regularly monitors grey seals using standard techniques. Surveying is mostly restricted to sites in Scotland, where over 90% of each species are found. Data from these and other monitoring programmes were used to identify and define candidate SACs and will provide important contextual information against which the results from future SAC monitoring studies may be compared. Selection of cSACs was based on the estimates of pup production at individual colonies, largely derived from SMRU’s annual aerial survey programme. At other colonies, such as the Farne Islands and south-west Wales, pup production is estimated from ground counts. Total population size is estimated using a model. Presently, this total population estimate is for the UK population as a whole but alternative models are being developed which should provide more local estimates of population size.

SMRU has completed several surveys of population size, diet, movements and foraging behaviour and genetic diversity (e.g. Hammond et al., 1994a, 1994b; Matthiopoulos 2003; SCOS, 2003; McConnell et al., 2004). In Wales, others have conducted population estimates of pup production and seasonal abundance and distribution using direct pup counts (Baines et al., 1995; Westcott, 2002) and mark-recapture methods using photographic identification of adult female pelage (Kiely et al., 2000). Surveys have been carried out in Skomer Marine Nature Reserve annually since 1983 (e.g. Boyle, 2001).

3.2 Assessing the status of grey seal pup production

3.2.1 Pup production in the SAC/SSSI/ASSI

The number of breeding females is of particular interest. As females are assumed to give birth to one pup in any one breeding season, pup production can be used as a suitable indicator of breeding female abundance. Consequently, *pup production in the SAC/SSSI/ASSI* is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

3.2.1.1 Background to the attribute

Pup production at all the major Scottish breeding colonies is monitored annually by SMRU. The National Trust conducts annual ground counts of pups born at the Farne Islands. Pup production at colonies in south-west Wales has been conducted by CCW and Dyfedd Wildlife Trust between 1992 and 1994, though annual production estimates have been made for a number of colonies (e.g. Skomer, Ramsey Island). For the Scottish colonies and the Farne Islands there is a long time series of annual pup production estimates.

This is the only reliable consistent measure that can be made at all sites, and conducive to using different methods which suit different areas.

3.2.1.2 Setting a target

In principle the target should be set at no loss in pup production. It may be necessary to set a wide threshold target that allows fluctuations in pup production each monitoring cycle where there are sufficient data available to predict (via a model) a trend. Departure from this predicted target then would be a trigger for investigation and the feature may be considered unfavourable.

Overall, the annual rate of increase in pup production has declined in the past decade. During the late 1980s pup production was increasing by approximately 6% per annum, but over the last 5 years the rate of increase has reduced to less than 2% per annum (Duck, 2003a). The existing data series can be used to provide an indication of the possible extent of variability in pup production at individual colonies and overall trend in certain areas. For example, Duck (2003a) noted that pup production in the Inner Hebrides showed an annual increase of 9.8% between 1988 and 1992, whilst between 1993 and 1997 it reduced to 2.4% and between 1998 and 2002 reduced again to 0.9%. Similarly in the Outer Hebrides, pup production rates were 8.5%, 0.9% and -1.6% respectively (Duck, 2003a). At individual colonies, production can vary by ±23% within three years (Duck, 2003a).

When measuring pup production, the following issues should be considered:

- Mortality in the breeding colonies

Natural pup mortality varies between colonies and between years, usually between 2% and 5% but can rise to over 20% in certain colonies. In the SMRU production estimates, dead pups are included in the total. Changes in the numbers of dead pups in the colonies may reveal unusual events and should be noted. However, it should be noted that this would be difficult to achieve from boat counts without serious disturbance of the colony. SMRU has estimates of the numbers of dead pups for every colony on each survey.

- Starvation and infection

These are established sources of pup mortality (e.g. Baker & Baker, 1988; Twiss et al., 2003). Environmental changes, possibly related to the availability of prey, may be implicated in and may affect the year-to-year variation. Populations can also be affected by epidemics, climatic processes and changes in the food supply (changes in fish stock), which can lead to fluctuations in the reproduction.

3.2.1.3 Suggested techniques

Possible methods for measuring the pup production in the SAC/SSSI/ASSI are:

- Aerial photo-monitoring

The current monitoring programme undertaken by SMRU is likely to make a substantial contribution to condition assessment of Scottish and English SAC/SSSI/ASSIs. Currently, each discrete breeding colony in the Inner and Outer Hebrides, Orkney and the Isle of May is aerially photographed between three and seven times at regular intervals every year throughout the breeding season and pups are counted. Aerial surveys are carried out from a light twin-engine aircraft, using a large format aerial camera mounted in a vibration-damped, motion-compensating cradle.

- Direct counts from boat or shore;

The National Trust has carried out ground counts of pups born at the Farne Islands for many years. Counts are carried out every three days and the cumulative number of pups born is recorded. Elsewhere, pups are counted from boats or by swimmers (west Wales). These counts provide an estimate of the cumulative number of pups born over the breeding season. Within Wales, direct counts of adults and pups are made from the shore, by boat, with the use of wave-skis or abseiling from cliffs, because approximately 40% of the grey seal pupping habitat is located within coastal caves (Baines *et al* 1995, Westcott, 2002). Site identification and seal counts using aerial photography are therefore not suitable for much of the survey areas in Wales. The coastal topography of west Wales and the distribution of pupping sites are such that the comprehensive recording of pupping, which is undertaken at Skomer MNR for example, is not possible without enormous logistical and financial support. Consequently, monitoring pup production in west Wales is likely to be conducted at selected key sites (Baines et al., 1995; Strong 1995). In north Wales, the number of seals is sufficiently small to allow each site to be visited, thus providing a direct count of pup production.

3.2.1.4 Estimating population size

The number of pups born (pup production) at regularly surveyed colonies is estimated each year from counts from the aerial survey photographs using a model of the birth process and the development of pups. These estimates of pup production are good indicators of the general ‘health’ of the population. They are also used by SMRU as the basis for estimating, using a second model, the total size of the grey seal population. Recent changes in pup production indicate that the grey seal population is no longer increasing exponentially, an assumption made in the previously used model. New models that take account of these changes in grey seal population dynamics are under development.

3.2.2 Distribution of grey seal pups within the SAC/SSSI/ASSI

Distribution of grey seal pups within the SAC/SSSI/ASSI is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

3.2.2.1 Background to the attribute

Changes in the distribution of pups in a breeding colony can reflect factors affecting breeding seals, both positive and negative. At certain colonies, the area used by seals for breeding is increasing. At others, the area used has remained constant over a number of years while the overall production has varied. Monitoring changes in the distribution of pups over time can reveal areas that are particularly important to breeding seals. For islands surveyed aerially, historical photographs can be used to show the pattern of colony development.

Pup distribution can be affected by anthropogenic factors at some colonies, especially where livestock (mainly sheep) graze. Fences may be erected or dismantled both of which could affect the distribution of seals. Fences might be required to separate stock from seals or to restrict the spread of seals inland onto prime pasture.

3.2.2.2 Setting a target

The target should be a map showing the distribution of pups within each site. Additional features can be added to this map, including substrate or habitat type, fences or other boundaries, pools of water and streams. This will be more easily created for some sites than for others. Aerial surveys will provide most of the information required to determine the distribution of pups on a colony, particularly in Scotland and England. The colonies in west Wales and Shetland, where many breeding sites are in caves, will be more problematic. In addition, the distribution of pups will change as the breeding season progresses.

3.2.2.3 Suggested techniques

The most practical method of assessing the distribution of pups is by displaying aerial photographs in a GIS. SMRU is developing a system which will allow pup distribution to be monitored for each aerially surveyed colony. Ultimately it should be possible to geo-locate every seal in a colony from the photographs from every survey flight. For sites not surveyed aerially, pup distribution may have to be mapped by hand. In addition, dye-marking of pups and recognition techniques e.g. pup age estimates and occurrence of mother with identifiable pelage at pupping sites, allows the site fidelity of pups to be established and therefore pup distribution to be assessed (see Poole, 1996).

3.2.3 Accessibility of SAC/SSSI/ASSI for breeding

Accessibility of SAC/SSSI/ASSI for breeding is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

3.2.3.1 Background to the attribute

Seals require free access to and from their breeding colonies though the course of the breeding season. Restrictions to this access are likely to deter seals from using the colony and may result in a reduced pup production. Access to and from most breeding colonies is more or less unlimited. At certain colonies, such as North Rona and the colonies in west Wales, the natural access points to the breeding sites are very limited. Consideration should also be given to pups about to depart to sea for the first time. Some sites are used for livestock grazing, principally sheep. Fences may be erected or dismantled depending on husbandry requirements.

Habitat quality and extent

Some shore sites are not used by grey seals despite appearing to have ideal characteristics e.g. – remote from human/dog disturbance, adjacent to other seal sites, caves, boulder shores, islands and skerries, sand banks, pools of seawater in cave, immediate access to sea and a means of escape from threat. More investigation is required to explain this.

3.2.3.2 Setting a target

The target should be that grey seal access to and from the breeding colony is not restricted to any great extent. This is particularly important at colonies where natural access points are limited. Towards the end of the breeding season, the naïve pups will depart to sea for the first time. They are highly inquisitive and may be susceptible to, for instance, entanglement in the netting of fishfarm cages if these are sited close to the breeding colony.

3.2.3.3 Suggested techniques

Possible methods for measuring the accessibility of the site for breeding are:

- Aerial photography
- Habitat mapping
- Airborne remote sensing
- Shore survey
- Monitor disturbance events[3]

4 Background to harbour/common seal *Phoca vitulina* feature, background, targets and monitoring techniques for individual attributes

4.1 Background to harbour/common seal (Phoca vitulina) *feature*

Figure 4: Harbour seal *Phoca vitulina* (Lighthouse Field Station, University of Aberdeen).

The harbour seal *Phoca vitulina* (also known as the common seal) is the smaller of the two species of pinniped that breed in Britain. Adults typically weigh about 80-100 kg, with males being slightly bigger than females. They are long lived, surviving to 20-30 years of age (SCOS, 2003). Approximately 40% of the European harbour seal population resides in UK waters (Duck, 2003b). Between 1996 and 2001, 33,800 common seals were counted in the whole of Britain, of which 29,800 (88%) were in Scotland and 4,000 (12%) were in England (SCOS, 2003). The total British population cannot be estimated accurately, predominantly

[3] Disturbance in breeding areas may reduce pup production.

due to the amount of time the seals spend in the water, but is actually thought to be approximately 50-60 thousand animals (SCOS, 2003).

Distribution

Harbour seals are found all round the UK coast. They tend to occupy more sheltered waters than grey seals. The greatest numbers are found on the west coast of Scotland and throughout the Hebrides and Northern Isles; they are also observed in more restricted locations on the east coast (the Wash, Firth of Tay and Moray Firth) (SCOS, 2003).

There are nine cSACs in UK waters designated specifically for harbour seals chosen for their importance as general haul-out sites and for moulting and pupping. These are: Mousa and part of the Yell Sound coast (Shetland), east Sanday (Orkney), the Ascrib Islands with Isay and Loch Dunvegan (Skye), Lismore, the south-east Islay Skerries (west coast of Scotland), the Dornoch Firth, the Firth of Tay including the Eden Estuary (Scottish east coast), and the Wash and north Norfolk coast (England). Two additional cSACs also list harbour seals as a qualifying feature but not the primary reason for selection. These are Murloch and Strangford Lough, both in Northern Ireland. In addition, harbour seals may also be listed as a qualifying feature in some coastal SSSIs and/or ASSIs.

Habitat requirements

Harbour seals require suitable haul-out sites where they can rest, moult and give birth to and raise their pups. They routinely haul out at low tide on intertidal sandbanks, skerries or beaches (Duck, 2003b). The number of seals at haul-out sites varies through the year. In the winter months, harbour seals appear to spend more time at sea, presumably feeding (Thompson, 1989). During the breeding season (from late May to early July), harbour seals appear to be more dispersed and in smaller groups than during their moult. From late July to early September, during their annual moult, groups tend to be larger than at other times of the year and numbers at many haul-out sites appear to be at a maximum (Thompson, 1989).

Harbour seals regularly use the same haul-out sites (Corpe, 1996). Their day-to-day choice of site is most notably affected by wind strength and direction; harbour seals prefer to use sheltered sites (Grellier et al., 1996). Genetic studies have shown that, at a large scale, there is little interchange of individuals between populations, at least there is no genetic interchange (Goodman, 1998). Studies have shown that seasonal changes in site use may be linked to a site's physical characteristics. Some may be suitable for breeding females during pupping, others may be more suitable for groups undergoing the annual moult, others because of seasonal proximity to a food resource (Grellier et al., 1996; Leopold et al., 1997; Härkönen et al., 1999; Härkönen & Harding, 2001).

Movement, foraging and diet

Until recently, direct information on foraging movements and the distribution at sea of harbour seals was limited to small-scale land-based VHF radio telemetry studies. These results are summarised by Thompson et al. (1989), Thompson & Miller (1990), Thompson et al. (1991) and Thompson et al. (1996). They showed that harbour seals moved to alternative haul-out sites within a range of 75 km and that all harbour seals appeared to forage within 60 km of their haul-out sites. More recently, satellite tracking data have highlighted different foraging behaviour off southeast Scotland and around Orkney and Shetland (SMRU unpublished data). Off southeast Scotland, animals were found to be very faithful in their use of haul-out sites on land, and moderately site-faithful in the areas individuals used to forage. Distance travelled to areas where seals were assumed to be foraging ranged from 10 km to 120 km, with a mean of 46 km. Duration of trips ranged from less than one day to 23 days, with a mean of 4.5 days. Foraging in the Moray Firth was mostly closer to the shore. Around Orkney and Shetland, there were indications that seals tend to move between haul-outs sites within a 40 km radius, although one animal hauled out as far as 200 km from where it was initially tagged. Foraging behaviour is therefore variable both in distance travelled and in the duration of trips.

Harbour seal diet can be summarised as taking a wide variety of prey including sandeels, whitefish, flatfish, herring and sprat, octopus and squid. The diet, however, varies seasonally and from region to region. In the Moray Firth, Tollit & Thompson (1996) found the key prey to be sandeels, lesser octopus, whiting, flounder, and cod whilst Pierce et al. (1997) and Tollit et al. (1997) observed seasonal and annual variation in the diet depending on prey availability. In Shetland, Brown and Pierce (1998) found that gadoids (particularly whiting and saithe) accounted for an estimated 53.4% of the annual diet by weight, sandeels 28.5% and pelagic fishes 13.8%. There were also strong seasonal patterns, with sandeels being important in spring and early summer, and gadoids in winter. Pelagic species (mainly herring, garfish and mackerel) were important in late summer and autumn. In The Wash, diet was dominated by whiting, sole, dragonet and gobies, with a strong seasonality apparent (Hall et al. 1998). In northeast Ireland, Wilson et al (2002) found a shift in diet from predominantly flatfish to gadoids (whiting, haddock, pollock and saithe) over a 5 year period, thought to be associated with declines in particular fish stocks. In the Inner hebrides, Pierce & Santos (2003) observed gadoids (particularly whiting) along with pelagic scad, herring and cephalopods in the diet, with distinct temporal and spatial variation in diet.

Maintenance of viable populations within SAC/SSSI/ASSIs is therefore clearly linked to the availability of suitable haul-out sites with foraging areas nearby (<60km) throughout the life cycle. However, harbour seals are a mobile species and there is some evidence of redistribution over a period of a few years, which suggests that they may alter the emphasis of use of certain areas in favour of others.

Reproduction

Female common seals mature at 3-4 years of age, with first parturition one year later, whilst males mature at 4-5 years old (Härkönen & Heide-Jørgensen, 1990). Mating occurs exclusively at sea. As such, it is unlikely that most pups will be sired by a small number of highly successful males, while females demonstrate little mate fidelity between breeding seasons (Coltman et al., 1998).

Adult females bear a single pup between late May and early July (Duck, 2003b). Pups are born without a white coat, which is usually shed *in utero*, and can swim almost immediately, with many being born below the high water mark (Duck, 2003b). They are weaned after about 4–5 weeks (Dube et al., 2003). Mating occurs soon after weaning. Harbour seals differ from grey seals in that they do not aggregate into discrete colonies to breed. In contrast, females appear to move away from larger groups to give birth and raise their newborn pups in very small groups, returning to form larger groups when the pup is sufficiently old. The dispersed nature of the breeding groups and the fact that pups are able to swim within hours of birth contrive to make estimating pup production in an area extremely difficult. Females with pups can be very widely dispersed and some pups may be at sea with their mothers at the time of survey

Current Monitoring Programmes

The Sea Mammal Research Unit (SMRU) monitors the UK harbour seal population as part of NERC's statutory obligation under the Conservation of Seals Act 1970 (see annual updates in

SCOS documents at www.smru.st-and.ac.uk). Monitoring surveys are carried out annually in Lincolnshire and Norfolk and on an approximate 5-yearly cycle around Scotland. The surveys are carried out during the harbour seals' annual moult when the greatest and most consistent numbers of seals are ashore. To further maximise the number of seals counted, surveys are restricted to two hours either side of low tides which occur between 1300 and 1900hrs. Thus the surveys result in an estimate of the minimum number of harbour seals in the area surveyed.

Harbour seals are monitored in the Moray Firth using counts made from land by the University of Aberdeen Lighthouse Field Station.

4.2 Assessing the status of harbour/common seal populations

4.2.1 Number of harbour/common seals present during moulting season in the SAC/SSSI/ASSI

The *number of harbour/common seals present during moulting season in the SAC/SSSI/ASSI* is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

4.2.1.1 Background to the attribute

cSAC site selection was based primarily on data collated by SMRU during routine surveys of harbour seals around the UK. The primary data used were counts made during August, when the seals moult. Additional breeding season surveys have been conducted of most, but not all SACs.

4.2.1.2 Setting a target

In principle the target should be set at no loss in the abundance of harbour seals. It may be necessary to set a wide threshold target that allows fluctuations in number each monitoring cycle where there are sufficient data available to predict a trend using a model. Departure from this predicted target then would be a trigger for investigation and the feature may be considered unfavourable.

When measuring the number of harbour seals present, the following issues should be considered:

- Environmental conditions

The number of seals hauled ashore can be strongly influenced by the state of the tide, the time of tide during the day, wind strength and amount of precipitation. Surveys should be carried out under standardised conditions as far as is practical.

- Phocine Distemper Virus

In 1988, the phocine distemper virus epizootic was first reported from the Wash and then spread to the east coast of Scotland. During June and July 2002, a virus virtually identical to the 1988 strain of PDV was again detected in the Kattegat and Dutch Wadden Sea areas. That outbreak showed similarities to the previous one: same original location, similar time of year (start of the breeding season). Initial results indicate that a larger proportion of harbour seal population died in England died during the 2002 outbreak; with 23% reported for the Wash in 1988 and 35% in 2002 (SCOS, 2003). The reverse was found for Scotland; 6% and 4 respectively for the Tay estuary and 7% and 4.5% respectively for the Moray Firth (SCOS, 2003).

- Estimating moulting numbers

The current surveillance programme undertaken by the SMRU is likely to make a substantial contribution to condition monitoring of SAC/SSSI/ASSIs. Currently, SMRU surveys harbour seals annually in Lincolnshire and Norfolk and approximately every five years at a variety of sites in Scotland. Surveys are carried out in August during the moult within two hours either side of low tides occurring between 13:00 and 19:00 hours. For rocky or seaweed dominated sites, seals are surveyed using a thermal-imaging camera mounted on a helicopter to discriminate the well-camouflaged seals from the background (Figure 5). Helicopters are preferred to fixed-wing aircraft because they can carefully follow the shore along a complex coastline. Conventional aerial photography is used for the east coast sandbank sites where those seals hauled out are conspicuous against the background sediment (Figure 5) (Thompson & Harwood 1990).

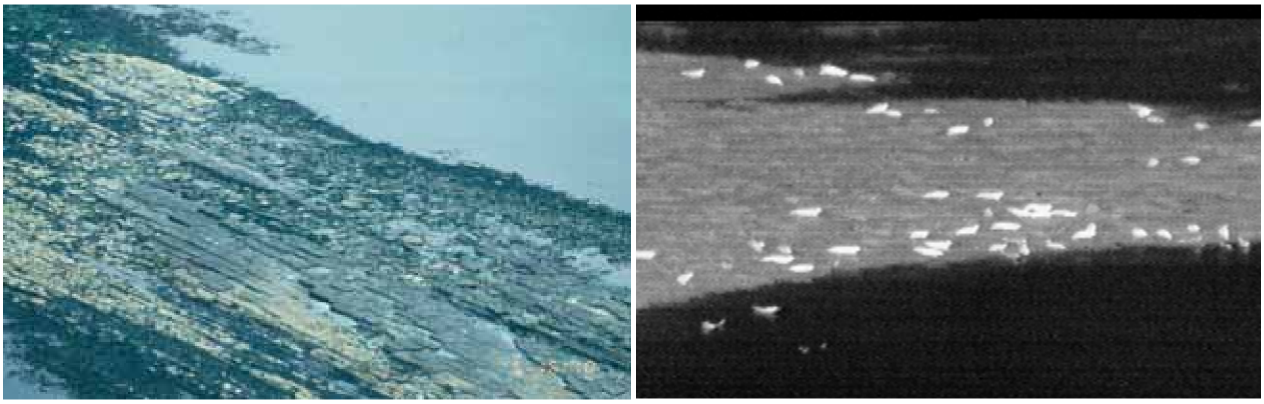

Figure 5: A conventional photograph (left) and a thermal image (right) of common seals on a skerry in Scotland (C. Duck, SMRU).

Although these surveys coincide with the period when the maximum number of seals is likely to be ashore, there will be an unknown number of animals in the water at the time of survey. Research studies in Orkney, the Moray Firth and the Wadden Sea estimated the ‘correction factors’ required to convert the counts into estimates of the local total population size (Thompson & Harwood, 1990; Thompson et al., 1997; Ries et al., 1998). Counts should be carried out under similar conditions (e.g. state of tide, weather, moulting stage, time of year). In the Moray Firth, the proportion of seals hauled out was estimated to be 0.5–0.75 of the total population (Thompson et al., 1997). It is important to establish the activity patterns of the seals when planning any census as the habitat can strongly influence the animal's behaviour (Härkönen et al., 1999). For example, harbour seals on rocky shores in Orkney had diurnal patterns of activity, whereas in the Moray Firth the availability of haul-out sites on sandbanks depended on the tidal cycle. Census techniques must minimise within-year variation by investigating activity patterns at a local level. The study in the Moray Firth concluded that population trends may be detected over 4–6 years using annual counts based on 2–3 visits per year; >5–6 visits per year were found to be inefficient.

4.2.1.3 Suggested techniques

Possible methods for measuring the number of harbour seals present during moulting season in the SAC/SSSI/ASSI are:

- Thermal aerial photography

Thermal imager mounted in a helicopter is most suitable for surveying rocky coasts where harbour seals can be well camouflaged.

- Aerial photography

Conventional aerial photography, either vertical or oblique, is suitable for estuarine sites where harbour seals haul onto sandbanks and are quite conspicuous.

- Direct counts from boat or shore

Land or boat-based counts may be cheaper alternatives to aerial surveys but have their limitations. Seal are less visible and may be more likely to be disturbed prior to, or during, counting (Duck, 2003b).

4.2.2 Distribution of moulting harbour/common seals within the SAC/SSSI/ASSI

The *distribution of moulting harbour seals within the SAC/SSSI/ASSI* is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

4.2.2.1 Background to the attribute

SACs were selected on the basis of the numbers of seals using a relatively definable section of coast. It is important to monitor changes in the distribution of seals within the area defined. Given that harbour seals are highly mobile, it is also important to consider the numbers and distribution of seals in areas adjacent to the designated SAC area. This will put the local SAC seal population in its correct context. These latter comments also apply to relevant SSSI and ASSI sites.

4.2.2.2 Setting a target

The target should be a map showing the distribution of harbour seals within each site. It would be useful to have, in addition, a distribution map showing harbour seal distribution from previous surveys.

4.2.2.3 Suggested techniques

Possible methods for measuring the distribution of moulting harbour seals within each site are:

- Aerial survey
- Boat or land survey
- Remote camera survey

The information from the surveys (number of seals and the location of the haul-out sites) can be displayed using a GIS and compared with data from previous surveys.

5 Background to bottlenose dolphin *Tursiops truncatus* feature, background, targets and monitoring techniques for individual attributes

5.1 Background to bottlenose dolphin Tursiops truncatus feature

Figure 6 Bottlenose dolphin *Tursiops truncatus* (Lighthouse Field Station, University of Aberdeen).

This species is widely distributed in the North Atlantic, West African, Mediterranean and UK coastal waters, with most sightings within 10km of land. Bottlenose dolphins may reach approximately 4m in length in north east Atlantic, but tend to be smaller elsewhere (2.5-2.7m) (Kastelein et al., 2002; Stolen et al., 2002; Reid et al., 2003). Bottlenose dolphins are long-lived marine mammals, reaching 40-50 years of age (Thompson pers. comm.).

<u>Distribution</u>
Two predominant populations occur in UK inshore waters – Cardigan Bay and the Scottish east coast (Reid et al., 2003). In addition, small groups appear to be resident or near-resident in waters off Cornwall and Dorset (Williams et al., 1996; Wood, 1998). The total population in the inshore waters of the UK is probably between 300 and 500 individuals (Reid et al., 2003). Their diet is predominantly fish (mainly saithe, cod, and whiting, but also salmon, bass, sprat and sandeels), although cephalopods (squid and cuttlefish) are also consumed (Santos et al., 2001; Reid et al., 2003).

In order for cSAC site designation under the Habitats Directive to be an appropriate mechanism for protection of Annex II species, it is expected that clearly identifiable areas can be defined that have the physical and biological factors essential to the life and reproduction of a population of the species. Only two areas in UK waters, the Moray Firth and Cardigan Bay, have been identified that meet this criterion for bottlenose dolphins; both these localities have been selected as cSACs. While the individuals using the two sites may range further a field for part of the year, dolphins are present throughout the year and recognised individuals have been seen over periods of several years. This repeated occurrence and continual presence indicates that the sites are critical for the maintenance of these populations. In addition, the Lleyn Peninsula and the Sarnau cSAC in Wales lists *Tursiops truncatus* as a qualifying feature but not the primary reason for site selection.

SSSI and ASSI sites are bounded by the low water mark and do not extend subtidally. Consequently, there are no SSSI or ASSI sites associated with bottlenose dolphins.

Reproduction
Females reach sexual maturity at 5–12 years old and may produce a calf every 2-5 years throughout their life span (Haase & Schneider, 2001). Urian et al. (1996) suggested that adaptations to local environmental conditions influenced the seasonality of reproduction. In UK waters, births occur over an extended period with a peaks in March to May and, possibly, during August and September. Weaning age can vary, usually occurring before the calf's fourth birthday, and coinciding with mid-pregnancy for the next calf (Mann et al., 2000).

Current monitoring programmes
Aberdeen University and the SMRU have studied the dolphin population in the Moray Firth since 1989 primarily using photo-identification methods to study the size and status of the population (Hammond & Thompson, 1991; Wilson et al., 1997, 1999b). A number of other studies have also been conducted, which include whistle matching, mother-calf association patterns and the occurrence of disease (e.g. Wilson et al. 1999a, 2000; Janik, 2000; Grellier et al., 2003; Hastie et al., 2004). In contrast, the dolphins of Cardigan Bay are less well studied; although work has been conducted on cause of mortality in stranded individuals (Kirkwood et al., 1997), the uptake of organochlorine pollutants (Law et al., 1995) and, more recently, distribution and habitat use in Cardigan Bay (Baines et al., 2002; Evans et al., 2002).

5.2 Assessing the status of bottlenose dolphin populations

5.2.1 Numbers of individual dolphins using the SAC

Numbers of individual dolphins using the SAC is deemed essential to assessing the condition of the feature and therefore must be assessed for all sites.

5.2.1.1 Background to the attribute

The numbers of bottlenose dolphins using a site is a basic attribute for this species. A site would be in favourable conservation status if numbers using the SAC stay within or above the normal level of variation. Short-term fluctuations may occur and also need to be allowed for – one estimate of numbers outside the normal level of variation should trigger further work to determine whether there was a temporary or permanent change in numbers.

5.2.1.2 Setting a target

In principle the target should be set at no loss in the number of individual dolphins using the SAC. It may be necessary to set a wide threshold target that allows fluctuations in numbers where there is sufficient data available to predict a trend.

The following issues should be considered:

- Habitat requirements

The precise habitat requirement of bottlenose dolphins is poorly understood. Dolphins use different areas through the year and their distribution shows distinct geographical stratification (Wilson et al., 1997; Hastie et al., 2003, 2004). This stratification may restrict the animal's movements in confined sites and they may not be able to move away from localised disturbance or pollution.

- Assessing numbers of dolphins

The only way to assess the number of individual dolphins using the SAC is to use mark-recapture methods applied to photo-identification data. Mark-recapture methods make a number of assumptions and these must be carefully considered when collecting and analysing data. For example, natural markings used to mark an individual must persist throughout the period covered by analysis and be sufficiently clear to ensure that if a marked animal is seen again it will be certain to be recognised (see Figure 7). The quality of photographs is important in this respect. Practical ways to minimise problems with using mark-recapture analysis of photo-identification data are described in Hammond (1986), Evans and Hammond (2004) and Thompson et al. (2004).

Figure 7. Examples of some of the main types of natural markings used to identify individual bottlenose dolphins in the Moray Firth population. Clockwise from the top left: dorsal fin nicks, depigmented areas, skin lesions and rake marks (Lighthouse Field Station, University of Aberdeen).

Shore or boat-based visual surveys that do not involve any identification of individual animals provide information on the number or density of animals in an area at the time of the survey but not on the number of individuals using the SAC. Nevertheless, series of visual counts in specific areas known to be regularly frequented by dolphins may be useful for assessing the effectiveness of any management actions and, if undertaken regularly, may act as a regular ‘health check’ of the use of such areas between monitoring events.

Passive acoustic monitoring of dolphin vocalisations may be useful for mapping the distribution of individuals within cSACs. This technique has the advantages of time/weather independence. However, because there are no data on the proportion of individuals vocalising at any one time, it is not possible to relate vocalisation rate to numbers of animals. Nevertheless, acoustic monitoring could provide a valuable adjunct to visual surveys as a tool for the long-term surveillance of dolphin activity patterns within an SAC.

SACs aim to represent important ‘sub-areas’ within the overall range of occurrence for a bottlenose dolphin population. Estimation of total population size, as opposed to the number of dolphins using the SAC, requires sampling over the whole range of the population using mark-recapture methods applied to photo-identification data. Identifying a statistically significant change in total population size can take many years (Thompson et al. 2000). Total population size may become a more viable attribute for use in the future with greater understanding of the population (Wilson et al. in press).

- Estimating population dynamics

Bottlenose dolphins are long lived (up to 50 yrs), reach maturity late (around 10 years) and reproduce slowly (approx. 5% yr; Wilson et al., 1999b). Natural fluctuations in the size of bottlenose dolphin populations, in the absence of significant emigration and immigration, are likely to occur slowly. Consequently, population dynamics are most sensitive to changes in adult survival rate and, to a lesser extent, sub-adult survival rate. These life history parameters can be studied using analysis of photo-identification data and used as input to a population model to predict the overall rate of population growth (Sanders-Reed et al. 1999).

A rapid decline in abundance is likely to reflect a natural catastrophic event or deleterious anthropogenic influence. Catastrophic natural events are usually identifiable. Rapid changes in abundance may occur well above a minimum acceptable level of overall abundance. There is the potential therefore for this method to provide an early indication of unfavourable condition well before a lower limit of abundance is reached. However, whilst there is great value in an early indication of unacceptable anthropogenic influence, lower limits for abundance must still remain in place to prevent an ‘acceptable’ rate of decline eventually leading to local extinction.

- Estimating age structure

Age structure and/or sex ratio have an important impact on population dynamics. Monitoring could only be achieved through very long-term studies that photo-identify all individuals at birth and use genetic analysis of biopsy samples to determine sex.

- Distribution

Information on dolphin distribution within the SAC can be obtained from boat-based visual and/or acoustic survey methods. This could lead to the identification of areas of particular importance offshore in addition to known areas close to land (e.g. Wilson et al. 1997).

- Assessing animal health

Monitoring of health is currently unfeasible. It is possible that visual signs such as changes in behaviour or skin lesions may be indicators of health but no clear links have yet been established. Tissue samples used for chemical and/or histological analysis would probably provide the information required. However, the importance of this attribute is not sufficiently high to justify the removal of tissue samples from live individuals.

The incidence of skin lesions appears to be related to environmental stress, but it remains unclear to what extent these stressors are of natural or anthropogenic in origin (Wilson, et al. 1999a, 2000). Wilson et al. (1999a) found that the occurrence and severity of skin lesions was related to water temperature and salinity. The bottlenose dolphins of the Moray Firth are the most northerly population in the world and, as such, experience lower water temperatures than other populations. It has been suggested that the incidence of some skin diseases may be related to anthropogenic contamination (Van Bressem et al., 2003), but there is no evidence that this is the cause of the high levels of skin lesions in the Moray Firth (Wilson et al., 1999a). Nevertheless a precautionary approach to cSAC management would be advisable.

Populations have only been studied for a proportion of an individual's likely life cycle (approximately 15 out of 40-50 years) and chronic effects are unlikely to have been detected.

Some limited information sufficient for surveillance, though potentially unrepresentative, is gathered in this way from dead strandings and should continue. Analysis of stranded animals or corpses may provide surveillance data to support an assessment of the 'health' of dolphin populations. The UK Government funds schemes to report and collect stranded carcasses for post-mortem analysis. Cause of death is ascertained, where possible, during post-mortem and summary standing reports published at regular intervals.

5.2.1.3 Suggested techniques

Possible methods for measuring the numbers of individual dolphins using the SAC are:

- Mark-recapture analysis of photo-identification data
- Visual survey techniques
- Acoustic survey techniques

6 Generic attributes tables for marine mammals

This section contains the attribute tables for monitoring individual interest features. They should be used in conjunction with the relevant sections of the guidance above to set conservation objectives in the form of attributes and targets for monitoring as appropriate to each specific interest feature.

Table 1. UK guidance on conservation objectives for monitoring designated sites

Interest feature: Grey seal *Halichoerus grypus*

Reporting category: Mammals

NB: All attributes listed are mandatory

Attribute	**Targets**	**Method of assessment**	**Comments**
Pup production in the SAC/SSSI/ASSI	A stable or increasing number of breeding female grey seals in the SAC/SSSI/ASSI	Pup counts from aerial photography and extrapolation; direct counts from boat or shore	Pup counts standardised and extrapolated to give an annual estimate of production. Extrapolation to be based on work in SAC/SSSI/ASSI where possible Counts once every three years, ideally more often.
Distribution of grey seal pups within the SAC/SSSI/ASSI	A stable or increasing area of usage within the SAC/SSSI/ASSI	Aerial photography or direct mapping from boat or shore	Can be carried out at same time as above
Accessibility of SAC/SSSI/ASSI for breeding	An accessible breeding site	Aerial photography or direct mapping from boat or shore	Can be carried out at same time as above

Table 2. UK guidance on conservation objectives for monitoring designated sites

Interest feature: Harbour/common seal *Phoca vitulina*

Reporting category: Mammals

NB: All attributes listed are mandatory.

Attribute	**Targets**	**Method of assessment**	**Comments**
Number of harbour seals present during moulting season in the SAC/SSSI/ASSI	A stable or increasing number of harbour seals present in the SAC/SSSI/ASSI during the moulting season	Aerial photography; direct counts from boat or shore during moulting season; remote camera monitoring	Counts every five years as a minimum, although more frequently preferred
Distribution of moulting harbour seals within the SAC/SSSI/ASSI	A stable or increasing area of usage within the SAC/SSSI/ASSI	Aerial photography or direct mapping from boat or shore	Can be carried out at same time as above

Table 3. UK guidance on conservation objectives for monitoring designated sites

Interest feature: Bottlenose dolphin *Tursiops truncatus*

Reporting category: Mammals

NB: All attributes listed are mandatory

Attribute	**Target**	**Method of assessment**	**Comments**
Numbers of individual dolphins using the SAC	A stable or increasing number of dolphins using the SAC	Photo-ID and mark-recapture extrapolation techniques	Surveys every three years, ideally more often

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