Natural England Research Report NERR017

Procedural guidelines for studying grey seals in southwest England, 2006

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Project details

This report results from research commissioned by Natural England in order to further the understanding and knowledge of grey seals in south west England and to inform methods and procedures for monitoring seals and the sites they use that will generate datasets to help inform how targets could be set for their management.

A summary of the findings covered by this report, as well as Natural England's views on this research, can be found within Natural England Research Information Note RIN017 - Procedural guidelines for studying grey seals in southwest England, 2006.

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Summary

Introduced, described, assessed and presented here as the basis for future monitoring of grey seals in southwest England are the techniques tested at North Wales sites between 2001 and 2005 and at southwest England sites between 1991 and 2000 and in 2006. This includes recommendations about how to store the data in site-based and (individual) seal-based catalogues.

The guidelines describe how to collect the several types of seal and seal site data that will be required to inform discussions and decision-making by coastal managers in ways that are repeatable and comparable between sites and over long periods of time. Data collection and research undertaken on behalf of Natural England should conform to Natural England's requirements to ensure compatibility with GIS systems and allow appropriate access of data to all Natural England staff.

The guidelines are designed in such a way that each section can be read without reference to any other except the 'Procedural guidelines applicable to all fieldwork', which should be read regardless of the type of fieldwork being undertaken. Therefore, anyone reading through the entire set of procedural guidelines and appendices will find that there is a measure of repetition.

Background

Until 1990, the principal focus of grey seal research in southwest England was to identify nursery sites. However, some additional work had been carried out on weaned grey seal pups, investigating their dispersal pathways from southwest Wales nursery sites in the 1960s and 1970s by means of flipper-tagging (Johnson, 1972), relying on re-sightings on southwest England beaches.

Responding to advice in the last SMRU survey of nursery sites (Prime, 1985), locally based work by Westcott between 1990 and 2000 established the timing of the season of pup production (1996), provided full season counts of pup production at two west Cornwall sites (1994-1998), identified moulting sites (1993-2000), initiated the photo-identification of individual seals (1994), examined disturbance impacts and solutions (2000) and investigated seals-fisheries conflicts and ways these might be mitigated in collaboration with the Cornwall Fish Producers Organisation (2000).

In addition, a substantial list of sites used by seals in the southwest identified primarily by Westcott for SMRU was incorporated into the JNCC Coastal Directories (1995).

Since 2000, greater and more coherent effort has been made to develop a photographic identification catalogue for seals in the region, mainly based on sites in the vicinity of Godrevy Point. However, funding has not been available to use the computer-aided digital seal image-matching programme developed by Hiby and Lovell (1990), a programme that was used in a joint Wales-Eire study of grey seal movements in the Irish Sea between 1994 and 1999 (Kiely et al, 2000) that resulted in the compilation of the EIRPHOT catalogue of images of individual seals.

From 2000 onward, greater and more coherent effort has been made to protect seals and the sites they use from disturbance. These have been based on a combination of site studies that informed the WiSe scheme (described below). The objective of these southwest Britain (southwest England and north Wales) studies was to mitigate impacts locally, on a district-by-district basis. The fieldwork was followed by meetings with people who could be affected by the recommendations arising out of the study findings. These began in the Dart Mew Stone and Peartree Point, Devon (2000) districts.

Seal identity studies based on photo-identification have quickened in the current decade (since 2000), one being based on individuals using (primarily) the Godrevy coast (Cornwall Seal Group) another being based on seal mothers at nursery sites on the Isles of Scilly, Lands End, Godrevy & Boscastle (Westcott) and the third being based on disturbance studies in south Devon.

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1 Introduction

1.1 The UK populations of grey seals represent slightly less than 40% of the world population and 95% of the EU population (Davies et al., 2001). At the start of the 2000 breeding season, Great Britain held some 124,000 grey seals with a further 300-400 around the Isle of Man and Northern Ireland (SCOS 2003). The grey seal 'colonies' of southwest England (Isles of Scilly, Cornwall, Devonshire and Lundy) represent less than 1% of annual UK pup production (SCOS 2003) and the population is described as 'stable' by the Natural Environment Research Council Special Committee on Seals (2003).

1.2 In order to asses conservation priorities and set appropriate objectives, the first imperative is to review the current status and range of the grey seal in southwest England, setting this in the context of the north-east Atlantic range of the species. In order to make those judgements, two fundamental questions need to be answered:

- What is the range of the species and is it changing?
- What is the population size and is it changing?

1.3 This report outlines methods that can be repeated at intervals in order to generate the quality of data required as the basis for making those assessments.

1.4 Not included in this essentially site-based report is the full array of means of tracking seal movements at sea. Components of that array would have to be deployed to generate the remainder of the data required on which sound management decisions could be made.

1.5 The most recent survey conducted by the Sea Mammal Research Unit (SMRU) in southwest England was confined to Cornwall sites and conducted by Prime (1985). As with the previous survey carried out in 1973 by the forerunner of the SMRU, the Seals Research Division effort (Summers, 1974) was disrupted by adverse sea conditions and by the fact that there were too many potential seal sites to be visited in the short period of time available.

1.6 Responding to the observation in Prime (1985), that regular survey work must be carried out through a breeding season whose timing was yet unclear, Westcott provided baseline data to SMRU on the timing of the season of pup production, full data on pups born in certain localities, seal distribution at haul-out sites, water resting places and in estuaries (JNCC Coastal Directories, 1995) and initiated photo-identification studies of individual seals. In 2000, he carried out disturbance and seals-fisheries interactions studies. In 2005, he carried out a seal cave survey of Cornwall, mapping all known sites, this being the essential prelude to any full scale or local study of annual pup production and seal abundance.

1.7 From 2000 onward, the Godrevy Seal Group (later renamed the Cornwall Seal Group), a group of volunteers, carried out photo-identification of seals (initially and principally in the Godrevy district) as well as collecting abundance and disturbance data.

1.8 However, at present, no estimate of the regional population size can be made with confidence, and this also applies to estimates of pup production. However, tentative pup production estimates given to SMRU by Westcott suggest annual pup production at approximately 260:

- Isles of Scilly: 70
- Cornwall: 150
- Devonshire: 10
- Lundy: 30

1.9 For grey seals, it is customary to extrapolate a population size from pup production figures. However, recent research in North Wales carried out for the Countryside Council for Wales by Westcott (2002, 2003) suggests great variation in seal abundance through the year, both between sites and at sites, rendering such extrapolations unhelpful to coastal managers.

1.10 Subsequently, Hiby (pers. comms., 2003) suggested that current means for estimating pup production are inaccurate (for example, taking no account of fecundity rates in mature females) and cannot be expected to provide the basis for assessing the condition of a population.

1.11 Recent CCW-managed, well-funded and well-supported research carried out in North Wales is relevant to research in southwest England, where only minimal funding has been available since the 1981 survey. This has limited the potential research effort in a region where rocky coasts open to the full force of the Atlantic waves are long and complex, and sea conditions render access to sea caves difficult.

1.12 The procedures devised, methods deployed and results achieved in Wales, were the maturation of a decade of survey effort at seal sites primarily located in southwest England. They are designed to facilitate repeatable studies that are entirely comparable with the work done as baseline studies between 1994 and 2000, so far as advances in technologies permit.

1.13 Only by achieving methods and procedures that allow comparability, can the true fluctuations in the status of grey seals be recognised. This report is the pre-requisite for Natural England to instigate management measures designed to maintain grey seals in southwest England at the 'favourable condition' status required of them (in certain localities, by existing legislation).

1.14 What is required is a major, well-funded grey seal pup production survey for southwest England, coinciding with that rarest of years when the sea is peaceful enough to permit a full seasons worth of visits to all potential seal nursery sites. In the foreseeable future, in the absence of major funding, the collection of data is likely to remain in the hands of volunteers receiving, at best, occasional, low-level funding.

1.15 The procedures that follow are designed to allow volunteers, as much as fully trained seal scientists, to deploy methods that would enable the capture of data that is both repeatable, comparable and therefore of best use to coastal managers.

1.16 Details of the Pup Production guidelines have not been included in this report due to the specialist (licensed) nature of the work. The guidelines can, however, be obtained from Natural England (Truro Office) when the licence is applied for.

Objectives

1) To describe methods that are repeatable and comparable over time and between sites in order to record:

- Pup production (these detailed guidelines can be obtained from Natural England, Truro).
- Distribution and abundance of seals.
- Disturbance to seals.
- Seals-fisheries interactions.
- Tracking movements of individual seals: Photo-identification and cataloguing.

1.17 The methods are not complex.

1.18 They need to be used to ensure, by the calibration of methods and techniques deployed by individuals, seal groups and other organisations, that we have the basis for repeating studies. This is the pre-requisite for ensuring that results can be comparable over (long periods of) time.

1.19 Thus we have the basis for generating long-term data sets whose values and trends will inform decisions made about grey seals and the sites they use.

2) To describe the components of the databases required to store the information provided based both on seal sites and upon individual seals.

2 Procedural guidelines: applicable to all fieldwork

Preparation

- Prepare an itinerary for the day specifying how access to the site(s) will be achieved. State the time that you are setting out, state the time by which you expect to be back and advise on where the most difficult working conditions are anticipated. Contact your line manager or a nominated person directly (by meeting them or telephoning them - an answer phone will not do). In addition, send the line manager an e-mail containing the same information. It is imperative that full details of the planned work and location programme are shared with a reliable person who is geared to react at a specified time in the event of your not having returned.
- If possible, and where the situation is dangerous enough in the estimation of the fieldworkers, contact the line manager or the nominated person at the end of each site visit through the working day (by mobile phone or VHF radio).
- On fine scale maps, or using GPS co-ordinates, identify precisely where some of the equipment or clothing is likely to be temporarily stowed while the specific site is surveyed.
- Having described and made reference to plan views of every site that is to be visited, indicate how and where misadventure might occur. This may include reference to terrestrial and water features.
- Identify sites of refuge, if they exist, that might be used in the event of wind and sea conditions deteriorating.
- Keep a record of problems encountered or injuries suffered on each site visit and record these in a log at the end of the day. A copy of this log should be immediately shared via e-mail with the line manager, for use by emergency response personnel in the event of a drama occurring.

Ever-present considerations when carrying out data collection

1) What dangers are my colleagues or I likely to encounter here?

   a) Boulders are slippery.
   b) Boulders are unstable.
   c) Danger of rockfall, as where there has already been one recent fall (identifiable by the cleanness and paleness of the rock face where the collapse occurred), by the lack of vegetation growing there and by the pile of (relatively) sharp-edged and possibly less stable rocks below the site).
   d) Uncertain ‘floor’ where fieldworkers wade across tidal pools containing murky water.
   e) Seals hidden on the bottom of tidal pools, especially in sea caves, likely to panic, streak toward the sea, possibly colliding with fieldworkers.
   f) Where there is vegetation, it may not be stable. Do not trust it.
   g) Where vegetation is thick, such as in rushy areas, beware ‘holes’.

2) If walking on slippery substrate, **be constantly aware of how to fall in the event of your next step being a false step**.
3) Is your line of retreat, and that of any fellows in your company, secure? Do not allow a situation to arise where seals cut off your line of retreat or that of your companion. Most especially, where a tidal pool that is more than ankle deep forms part of your line of retreat, make sure you make yourself aware of every nook and cranny leading off both sides of the main site fairway and that you identify any seal in occupation of any of these. A seal can make a pool a no-go or a high-risk area for fieldworkers.

4) Where a seal or seals stampede, there are (sometimes, not always) three possible choices of how to react:

   a) If it is safe, especially where you are in a confined space, such as a sea cave, move as swiftly as is consistent with safety to a safe place that you should have identified on your initial site visit.
   b) Move to one side of the cave fairway and stand there, making no further movement. If you are carrying a paddle or a measuring stick, place it upright just forward of the part of your legs that is closest to the seals, so that in the event of a seal snapping at you in passing, it will bite something other than you. If you have accessed the site using a wave ski, lift it so that it is vertical and use in the same manner as described for the paddle and the stick.
   c) If possible - and where you are certain that the rocks are not slippery - try to climb upward until you are above their potential reach.

5) Where a seal corners you, although I have had no direct experience of this, the experience of others suggests that it is best to adopt a passive manner. Do not manifest any form of aggression if you are cornered. Crouching down and looking away has been one successful response deployed (where prior aggressive responses made at the outset of the encounter had made matters worse [Baines et al, 1993]). In this encounter, it is worth noting that an adult female initiated the aggression while in the water, where a fieldworker was swimming toward the shore. It is strongly recommended that even with boat support, site access be achieved either directly from the boat or via a wave ski. No aggressive encounters between seals and wave skis have been recorded, so far. The worst experiences to date have been the tendency of seal mothers to escort ski and rider closely (ie within one or two metres of the side, tail or underside of the ski), particularly during the season of pup production. Often, the first sense you are given of the presence and close proximity of a seal in such situations is a snort - air being expelled explosively through the nostrils - as the seal surfaces. Usually, it is directly behind you when it does this. This need not be interpreted as a signal of hostile intent, but remain watchful, as at all times.
6) Is your equipment secure against wave action, rising tide, wind action, damp or sand?
7) What is the tide doing?
8) What is the wind doing? Beware of clouds massing on the windward horizon.
9) Is there any change in sea conditions? For example, wave breaks occur at certain stages of the tidal cycle in the vicinity of certain seal sites (for example off Fire Beacon Point, north of Boscastle), over rocky outcrops as well as where the sea becomes shallow. Remember that change in sea conditions may be brought about by the topography of the benthos as well as by weather.
10) What is the time? This is most important in winter, when days are short. Then, quiet sunny days yield to dusk and evenings that can be bitterly and dangerously cold. It is also important when you are working in marginal conditions around the low tide window. Remember that you still have to get home safely afterwards. Carry extra clothing, especially hat, gloves and towel in your baggage.
11) Whatever work is undertaken in the field, the principal enemy of smooth working practices is dampness, made worse by the adherence of grit or algae to the skin. It is not enough to take one item to dry the hands. Probably, the best antidote to these problems is to carry several re-sealable polythene bags, each carrying tissues for the drying of hands.
12) If working with partners, never race against them. It is imperative to develop the most harmonious understanding, which means that both parties must work in the context of the spirit of compromise.
13) Spend always the least amount of time required to get the work done at all seal sites, but most especially those where pups are present.
14) Avoid causing unnecessary disturbance at all times, to the seals and to anything else.
15) Try to avoid drawing attention to yourself in the field, both from the seals and from people. Once people have observed you, you increase the possibility that others will follow your ‘footprints’ to the sensitive site at which you were working.
16) Make sure that everything that needs ‘back-up’ is doubly backed-up - for example lenses, camera bodies, batteries, films etc.
17) Clean all gear that needs to be cleaned at the end of every working day. Do not put it off.

18) Write up all notes at the end of the day. Do not put it off. Important information inevitably gets lost that way.
19) As part of your field notes, write down what equipment needs to be replaced at the time the need occurs. Draw up a shopping list at the end of the day and buy the replacement at the first opportunity. Do not let the priority of this task slide down the list.

Lone working or working without either cliff top or offshore (boat) support

1) This applies to lone fieldworkers, to teams exclusively using wave skis or other non-powered craft to achieve site access and where a team achieves site access by footpaths, tracks or by clambering over rocks.
2) Lone working is not advised but may result due to unavoidable or unforeseen circumstances. It is imperative that full details of the planned work and location programme are shared with a reliable person who is geared to react at a specified time in the event of your not having returned.

Ethical Considerations

2.1 The ethics of the research effort must be considered above all, but not only, because seal research in southwest England is undertaken to support conservation objectives in marine special areas of conservation and other protected areas.

2.2 The information that we need to collect about the seals includes where they occur, in what numbers, with what sex and age ratio and what the trends are for all of these features. We need to understand their movements, the reasons for them and to what extent these can be predicted. Because of the close proximity or inter-action of this species with the economic effort and leisure activities of humankind, we need to understand how seals use the coastal and aquatic environments, what pressures they exert upon fisheries as well as what and how human activity exerts pressures upon them.

2.3 However, it is evident that the behaviour of seals changes in response to the approach by humans over land or by boats across the water. Even where observation of seals is designed to be covert, the various research techniques that we deploy may affect individuals, groups or populations, thereby potentially occluding the understanding we seek to derive from our studies. Therefore, as it is likely that our research practises will modify the behaviour of the seals we are studying, it is important that we are able to demonstrate how our results will achieve conservation or protection benefits for the seals and the sites or inshore localities they use.

- We have to be clear about why the research has to be undertaken. If the research leads to recommendations about future management objectives, can we be confident that they will be implemented?
- The research plan and fieldwork should be designed to avoid, so far as is practicable, causing harm (here meaning disturbance, stress or injury caused to the seal while taking evasive action) wherever possible.
- The researchers should at all times practise the art of being invisible, so far as that is possible, to the seals. That means, where non-intrusive remote observations can achieve the results sought, they should be employed. Examples of remote observation include the use of telescopes, video camcorders, web cams and the array of remote sensing devices, including infra-red cameras bolted to sea cave roofs to monitor seal behaviour. Use should be made of hides.
- Where site access is unavoidable, it is imperative that the research team, ideally consisting of not more than two individuals, be soundly trained in good fieldcraft techniques. Apart from a standard method of preparation for working on any site, these would include moving silently as possible throughout the site visit, using topographical features for concealment, using the tide cycle to minimise the likelihood of causing disturbance and working as a team - making regular silent contact and communicating using sign only language. In the event of these

techniques proving inadequate and the seals are disturbed, there should be a practised array of routines for continuing to collect data while falling back to positions of safety.

2.4 The research plan and the fieldwork should be subject to independent inspection. The first inspection should be before the outset of fieldwork, this review being designed to examine whether the following inherent obligations have been recognised, accepted and incorporated into the survey design.

- Is the research necessary; what are the management objectives; when will they be implemented; what benefits are expected to derive from them and how will they be measured?
- The benefits must outweigh the costs; how can this be demonstrated?
- Is there a high probability that the scientific research objectives will be achieved and, if so, how will that be measured?
- How has the potential intrusiveness of the research programme on the individual seals and the sites they use been reduced to the minimum acceptable limits?
- When will the results be available and to which community of recipients will they be made available?
- Describe in what form and for what specific purposes the results will be made available to the general public. What guarantees can be inserted to safeguard the seals and the sites they use, arising from any dissemination or publication of results?
- Regarding data access; where sites or seals may be subject to disturbance as a result of the dissemination of the results, a system of licensing should be designed to protect the seals, the sites they use and, to some degree, the intellectual rights of the researchers.

2.5 At all times, the intention must be to cause no, or least, disturbance to seals. This will be achieved by venturing into the field with best available knowledge of seal behaviour and senses. Behavioural knowledge must be supported by best possible fieldcraft, here meaning the ability to approach as close as possible to seals, unseen and unheard by them, moving over what can be expected to be slippery or uncertain inter-tidal terrain.

- Having collected the data, it is imperative that the departure be as silent as the approach.
- At nursery sites, standard practise should be to spend least possible time on site while observing the principle outlined above.

2.6 The ethical challenge is most acute in sea caves, where general working conditions are most difficult and where any seal that is wakeful (meaning the great majority of seals) would already be ‘disturbed’ by, or at least aware of, the presence of fieldworkers (because of the noise made by the researchers and the use of lamps). Here, where the primary objective is to count and age seal pups, but where adults are also present, pup data be collected as quickly as possible and then followed by an immediate departure from the cave.

2.7 However, wherever possible, it is recommended that the fieldworker take up concealed positions with good views into the sea cave entrance. Ideally, these positions will be on the two sides of the cave entrance. This is in order to capture photo-ID images of seals if they respond to the research activity by exiting the cave. It has been the experience of the author that when researchers have departed the cave, so long as they remain unseen thereafter by the seals within, seals are likely to exit the cave in a period of time varying between immediately up to 10 minutes.

2.8 To capture photographic or filmic images of the seals at this time adds nothing or little to the disturbance already caused but adds greatly to the value of the site visit by collecting data that could add to life history data already held on individual animals and their relationship with that specific site and perhaps other adults using that site

2.9 Not all seal mothers will exit the cave after a visit by fieldworkers, especially where her pup is in the first week of life.

2.10 The more complicated question, ethically, is whether or not to try to capture any such photographic or filmic images inside the nursery cave, as this will entail shining lamps to illuminate the seal(s). Essentially, will disturbance of this nature at this sensitive time cause the mother to abandon her pup or, subsequently, to lose faith in the security of the site as a place to give birth to and nurse her pup?

2.11 The author favours capturing such images as opportunity permits. Based on 16 years of visits to sea cave nursery sites, the capture of such images does not damage the mother-pup bond - the heart of all ethical consideration. If a flashgun is used, attached to a SLR camera, the seal mother will flinch from the flash of light but does not otherwise react. If caught in a beam of torchlight so that an image can be captured using a digital camera, there may be no discernible reaction other than to stare back.

2.12 The reasoning here is that, given that a sea cave visit is inevitably noticed by any seal mother present, given there is no record of the mother-pup bond being damaged nor of change of site by seal mothers in subsequent years (although this requires further examination before it should be taken as definitive), it is not improper nor unreasonable to try to capture the images that will yield more insight into seal use of nursery sites.

2.13 This line of reasoning becomes more cogent in the following context. Except in a small sample of cases, surveys of pup production should happen only at intervals of five years in southwest England. This would allow detailed attention to be given to just one locality each season. In effect, these would have the function of keeping a finger on the wire, monitoring trends while keeping any potential disturbance caused by survey effort to the minimum. It would also allow a much more demonstrably accurate picture of pup production and its trends to emerge.

2.14 Examples of the ‘small sample of cases’ include studies of a series of consecutive breeding seasons at specific sites to monitor the underlying impression yielded by the results of the 5-year surveys, checking that our impressions are sound. Other exceptions will depend on the local context: on local impressions of change, of pressures bearing on seals at local sites (disease; disturbance; fisheries bycatch; a sudden rise in strandings and reports of unlawful seal killing).

2.15 It is likely that remote sensing tools will become increasingly available in the future, removing the need to spend so much time in caves, especially at the times of maximum sensitivity: during the periods of pup production and of moulting.

Health and safety considerations

2.16 Appendix 1 gives details of the Health and Safety protocol used by the Sea Mammal Research Unit.

Working from a base on a remote location

2.17 Before beginning the programme of fieldwork, the sites where the research is to take place must be described in detail, including especially on annotated maps of those sites. Information will indicate the land area and the proportions of different land types (for example, how many acres are under coastal grassland, how many acres consist of rocks or boulders, sand or gravel). Do trees grow on site? Are there any buildings? Can they be used? What condition are they in?

2.18 Aspects including the ownership of the site, whether there are public landing rights, whether there are public facilities must be addressed.

2.19 It is essential to be aware of all designations protecting the sites. For example, do they form part of a National Nature Reserve, a Site of Special Scientific Interest, a marine Special Area of Conservation, an Area of Outstanding Natural Beauty, a Special Protection Area and so on?

2.20 Do wardening operations take place on or overlooking the site? For example, are there seasonal operations by the RSPB, daily watches kept by Coastwatch volunteers, occasional visits made by Trinity House staff to carry out maintenance work on lighthouses, local Seaquest or seal groups or individuals with a special interest in particular localities? Do any of the operations receive an annual grant from Natural England, which has the statutory responsibility to ensure that the SPA and SSSI are maintained in favourable condition?

2.21 What responsibilities are exercised on the site or on adjacent lands by county councils, district councils, parish councils, the National Trust or other authorities and by landholders in receipt of Natural England or other conservation-orientated grants?

2.22 All means of access to all sites must be described:

- Is the site accessible from the land?
- Where the site is accessible from land, what is the degree of difficulty?
- Is there vehicular access to the site?
- Where the site is to be accessed from the sea, describe the distance to the nearest boat launching sites, including both slipways and harbours. Include in the description detail of the point at which the harbour dries out, if it is tidal.
- Describe navigation hazards that may be encountered at all states of the tide between the potential launching point and the sites where the research is to be conducted.
- Similarly, identify places where there are tide races.

2.23 For the sites where landfall must be effected, fully describe the landing places for all states of the tide and include all potentially perilous features (such as seaweed-covered landing steps or the difficulty of bringing a boat alongside at low tide because of the arrangement of the submerged rocks).

2.24 What considerations apply when working at remote (offshore) sites where permission has been received to use accommodation? The following considerations must be into account in the preparation of any Risk Assessment:

Emergency procedures

- Liaison with emergency services.
- Fire risk assessment.
- Lone fieldwork procedure.
- Security procedures.

Health and welfare procedures

- First aid: assessment of needs.
- Accident book.

Safety notes for storage and working procedures

- Machinery safety inspection procedures.

Equipment inspections

- Gas appliances.
- Electrical security.

Risk assessments and responses to emergencies

- Accommodation assessment.
- Personal assessments.

- Relevant equipment for staff and volunteers.
- Risk assessments for manual tasks.
- Foghorn noise assessment.
- Health and safety file.

Action plans

- Safety notes for the storage of gas, fuel oil and drinking water.
- Security response in the event of fire.

Special risks

- Fieldworkers on the archipelago are isolated from the mainland.
- Fieldworkers must be fully aware of emergency procedures for summoning help.
- Strict buddy-working procedures are required.
- The terrain may be mildly hazardous in daylight, but will be much more hazardous after dark, insofar as it might be pocked with rabbit burrows of varied size that may be partly concealed by vegetation. More hazardous are the rocks, which are slippery throughout when damp or wet. Most hazardous is access to any associated islets, where this is by means of tidal connections (bars or 'natural' boulder steps), as the sea is likely to run through strongly.

Accessing the site

- Ideally, a boat will be readily available throughout the research period, moored at the nearest harbour and, where necessary, functioning as the re-supply vessel.
- At present, the best boat for such work is a jet boat with a cabin, such as the CCW jet boat Pedryn, used in Wales (as at 2007) or privately owned commercial jet boats used in the Isles of Scilly.
- If fieldworkers are to remain on site for the duration of the research period, supply and re-supply must take place on an agreed basis - for example, every seven days, sea conditions permitting.
- Where heavy items, such as gas cylinders, butts containing fresh water and jerry cans containing petrol are to be unloaded, if the option exists to land these items at a landing stage, high tide is the ideal time from the point of view of the effort of unloading. However, the site could well be most exposed at high tide: such ramifications must be explored before the beginning of the research period.

Loading and unloading supplies

- A nominated load handler should supervise loading and unloading operations.
- Both at the points of loading and unloading, so long as the physical conditions permit, wheelbarrows should be used to carry supplies.
- Where the landing place is made treacherous by the seasonal growth of algae, they should be scrubbed clean at the outset, monitored and scrubbed again, at need. No detergent should be used.

On-site situation and secure storage

- Where accommodation exists on site, describe the access to it.
- Describe how freshwater run-off is captured. If no such facility exists, polythene sheets should be set up to channel rainwater to a covered container.
- Rainwater can be used for washing up, personal hygiene and for flushing toilets.
- Where such practises are used, one large bucket should be kept beside the toilet, one under the washbasin and one beside the sink in the kitchen.

- If an outdoor building exists, it should be used for accommodating the generator, along with one 5-litre can of petrol. The jerry cans containing the main supply of petrol should, if possible, be stored in another outbuilding. They should be lashed together with rope and secured against any possibility of straying in the wind.
- Similarly, both large and small gas cylinders should be stored away from the main accommodation and lashed together.
- A gas-powered refrigerator can be used for the storage of perishables, along with a gas-powered cooker although, if possible, the gas cylinder should be kept outside.
- Describe what the accommodation consists of: how many floors are there? How are the available rooms to be used? What facilities are to be found in the rooms? Which way do the doors open?
- If there is a kitchen, what kind of floor covering is there, are there storage cupboards on the walls or rising from the floor, is there a cooker and, if so, how many hobs are there and is there a grill? Is there a sink unit and draining board? Is there a table and are there any chairs?
- Are the rooms subject to mould?
- Do rooms have electrical sockets?
- Where will outdoor clothing be kept?
- Is there a washing line, either indoors or outside?

Use of fuels

- Large gas cylinders may be used for powering the cooker and for powering the refrigerator. They may be expected to last for about three weeks if the team is working in the autumn months and consists of two people.
- It is impossible to predict how much a small gas cylinder, used for powering the gas heater, might be used.
- A portable generator can be used to provide electricity. It may be used for up to several hours every day for the main part of the period, in order to recharge the batteries of computers, mobile phones, digital camera batteries and other rechargeable batteries. At the same time, use can be confined to the evening so that it will also generate light.
- Every 100 hours, the 4-stroke oil in the generator should be changed.
- At the end of the period, the generator is likely to be more heavily used as the results are compiled into a report.
- Where electricity is not available for lighting, gas lanterns or Tilley lamps can be used. Recent (2005) experience of Coleman's self-sealing gas cylinders found them to be inadequate for the task because they cut out repeatedly. This did not occur with the Campingaz lanterns.

Daily safety contacts

- Twice every day, for example after breakfast and before dusk, mobile phone contact must be made with nominated staff of the management agency.
- Once every day, in the late afternoon or evening, VHF contact should be made with Coastguard, via channel 16 before being immediately transferred to another (nominated) channel. The on-site VHF station can be powered by a (new) 12-volt car battery that should be kept fully charged. The siting possibilities for the antenna will determine where the station can be set up.
- A record of the phone and VHF contacts should be kept in a log book, along with the record of hours that the generator was run each day and when the last oil change was made.
- While carrying out fieldwork, fieldworkers must carry a rucksack equipped with a variety of items including VHF radio, walkie-talkie unit (for contact between personnel on the island), compass, whistle, head torch, towel, antiseptic wipes, a pad for sitting or kneeling on, and a first aid kit.

- In addition, fieldworkers should carry their personal mobile phones at all times (so long as there is reception). They must be stowed in waterproof bag (for example Aquapac).

Preparation for working on site: environmental influences

Weather

2.25 A variety of weather forecasts must be consulted before the site visit is launched.

2.26 The following sources should be consulted regarding the forecast for up to several hours beyond the expected conclusion of the day's work:

- Your own barometer, anemometer along with cloud type and movements. Your own record of wind speed and direction and of temperature.
- The shipping forecast for the local and surrounding sea areas. If, for example, the weather is coming from the southwest, then note should be made of the weather conditions in the appropriate neighbouring sea area to give you an inkling of what weather may be approaching. Not every forecast carries reports from inshore weather stations, but these are particularly valuable. A 24-hour regional inshore water forecast is available on BBC1 and BBC2 Ceefax 409. For regional inshore waters, the choice is Lands End to Colwyn Bay or St. Catherine's Point to Lands End.
- The local regional weather forecast for the land (also available on BBC1 and BBC2 Ceefax 402).
- BBC1 and BBC2 Ceefax 404 give current wind direction and speed, pressure, temperature and prevailing weather for nearby places. In southwest England, for example, consult information for Newquay and Plymouth. However, also check the nearest faraway places outside the region, depending where the wind is blowing from, to give yourself an inkling of what might be on the way. Examples of such places include St. Helier, Plymouth and Aberystwyth.
- Your own weather records should be maintained daily, recording wind direction and speed, temperature, barometric reading, sea state as well as notes describing the weather of the day. At monthly intervals, note the breakdown especially of wind direction and speed. Weather tends to get into ruts or habits that may endure for half a season, and this perception allows for a crude predictive ability to be developed. This may be especially true for wind speed and direction.
- Telephone the regional Met. Office or check the Met. Office website.

Tides

2.27 When planning visits to any site, thought needs to be given to:

- The time of **local** high and low tides.
- The phase in the lunar cycle between spring and neap tides, insofar as it influences tidal height and range.
- Barometric pressure, wind speed and direction also have an influence on tidal height and range.

2.28 It is essential that a timepiece, protected against dampness or from being submerged in water, be carried on every trip (eg watch, mobile phone).

2.29 In addition to tide height, it is imperative that local information be sought regarding the existence and nature of any local inshore tide races before any programme of fieldwork is undertaken. Ideally, this will be obtained from the coxswain of the local lifeboat, local inshore fishermen or the

local harbour master. More generalised information can also be obtained by studying Admiralty charts and tidal stream charts contained in the pages of a nautical almanac.

2.30 From the east to the west limits of the southwest region, there is a considerable but graded variation in tide times of about 2 hours. This means that any research effort recommended to take place around the low tide period can be extended each day, although this will entail long, cross-country drives or extended passages by boat. Nevertheless, this helps the research team take fullest advantage of each weather window, especially during the season of pup production.

2.31 Any survey work in southwest England requiring site visits, especially to sea caves, will be primarily subject to sea conditions in general, wave action in particular.

Wave action

2.32 The main environmental influence on seal sites in southwest England is wave action, strongly influenced by Atlantic weather systems, especially on the north and west coasts. This is to the extent that even when the wind speed inshore is at its lightest, wave action in the vicinity of (and inside) sea caves can be moderate. Moderate wave action makes achieving access to and working in most sea cave sites dangerous. Many, especially those with relatively narrow entrances, are made inaccessible in such conditions.

2.33 The one exception to this general rule is where the sea cave widens significantly inside the entrance and where there are known to be no hazards in the approaches to the cave beach. Here, wave action is likely to (although not certain to) dissipate, allowing access to the beach within.

2.34 Therefore, where any wind is blowing, the ideal condition is always to be working on the lee shore. In other words, if the wind is southeasterly, then that is the best time to be working on the northwest-facing coasts as, for example, north of Boscastle or along the Godrevy-St.Agnes coast.

2.35 The Western Rocks of the Isles of Scilly are designated the most wave-exposed rocks in England or Wales. The Norrard Rocks in the same archipelago are likewise extremely exposed. The sea state can prevent access to the vicinity of these sites, but wave action makes the achievement of landfall impossible. Here, the test of whether or not landfall is likely to be safely achievable is whether there is any surf at all playing on the rocks of Newford Island and Thomas Porth, on the northeast shores of St. Mary's Pool, across the water from The Quay. This is the guide generally used by island boatmen.

2.36 However, at all times, where landfall has been achieved and wherever there is the choice, approach seals from downwind of them.

Equipment and clothing checklist

- Equipment may be carried in pelican cases or dry bags (one dry bag, containing the equipment, secured inside a larger dry bag). The outer dry bag is necessary in that it protects the inner bag against the possibility of puncture when brushing by barnacles or sharp rocks). The dry bags should be lined and padded with material that will help minimise potential shock to the sensitive equipment being carried in the event, for example, of the fieldworker stumbling against a rock or falling over.
- Pelican cases provide greater and more reliable security against shocks as well as wetness. A partial negative here is the shape and weight of the large version of the case required in these situations: relatively heavy and cumbersome. The dry bags are most comfortably and safely carried in a rucksack, thereby leaving both hands free.
- Binoculars or telescope.
- Carry a stick on site, both to help maintain balance on a surface that is often slippery and for use in making rough measurements (of the site or of the corpses of marine mammals discovered stranded there). It can be divided into specific lengths by the use of electrician's

tape. However, if site access has been achieved via the use of a wave ski, the paddle (blades and stem) can be likewise converted into a crude measuring stick.

- Essential health & safety equipment to be carried on every trip includes First Aid kit, a GPS unit, flares, a hand held VHF radio, a mobile phone, a timepiece (if not displayed on mobile phone screen) and a foghorn (canister-powered).
- A knife should be carried at all times, principally to effect release from any entanglement in fishing net or line.
- If a single lens reflex camera with zoom lens is used, a detached flash unit, spare films and spare batteries for both camera and flash unit may also be needed, plus lens cloths. Spare memory cards, batteries plus lens cloths are also required if a digital camera or a digital SLR camera is used. Although both may feature built-in flash units, a Kowalski 620 or 1250 diving lamp should be used to provide illumination while capturing images in low ambient light conditions. A digital camera is useful, although the delay between depressing the shutter release and capturing the image is extremely frustrating.
- If a camcorder is used, a variety of spare batteries and videotapes will be needed.
- Films, spare batteries, lens cleaning fluid and lens cloths.
- There is a tendency for lenses to mist over while working in sea caves. Lenses may be wiped with a damp chamois leather kept in a dampened re-sealable bag
- Silicon crystals **must** be packed around all camera equipment, to help protect the gear against damp.
- A tripod is not essential, is likely to prove cumbersome to carry and may not be essential. However, wherever possible and where time permits, it should be used.
- It is imperative that as many towels as possible be carried where a dry bag is used. When working, two towels should be taken, one to be carried over the shoulders and used to wipe dampness or grit from hands prior to using equipment. The other can be used as a resting place for the camera. Dampness is omnipresent at seal sites.
- It is sensible to carry some blocks of foam, to use as padding when prostrate on the rocky shore attempting to capture photographic images.
- A waterproof notebook should be carried for making drawings and note making or, preferably, a white Perspex diver's slate, plus pencils and a rubber.
- Canisters of dye marking spray need to be carried where pups need to be marked (to prevent multiple counts of the same individual.
- It is useful to carry re-sealable polythene bags for the collection of (faecal?) samples.
- In many situations, it may be preferable to wear a dry suit. Where a wet suit is worn, a lifejacket should be worn at all times. If a wet suit is worn, it will be essential to wear wet suit boots at all times for protection against the rocky shores. Gloves and a hat will be essential during the coldest months of the year.
- For any element of the work taking place in sea caves, a helmet should be worn.
- Timer, set to go off at the (recording) interval required.
- Dictaphone, spare batteries and tapes.
- A hide, where appropriate, perhaps with a sheet of scrim to hold camouflaging materials.
- Wet weather gear.
- Towel, to keep hands dry and clean of grit.
- Sunglasses, particularly important in warding off the sea-glare.
- Protection against the effects of sunlight and insect bites.

Choice of boats to achieve site access

2.37 Different types of craft have different merits:

Rigid-hulled Inflatable Boats (RIB's)

2.38 These boats are widely used. They are fast, highly seaworthy and handled by competent boatmen. These allow best use of time available for fieldwork, something that is particularly useful during periods of stormy weather in which only one- or two-day windows of opportunity are available. They are reassuring when there is the need to get back to harbour in the context of deteriorating conditions. In addition, vulnerable equipment can be carried on board with ease and with great security. Furthermore, it is particularly reassuring to have such a 'guard vessel' outside a sea cave likely to be situated along a remote stretch of coastline in which you are working, ready to respond if you get into difficulty. Negatives are their effect on the environment, particularly via the heavy consumption of fuel, potentially high maintenance costs and the discomfort of making passage in a bumpy sea.

Local fishing/lighthouse supply & maintenance boats

2.39 These boats may be hired. They are slower than RIB's and more comfortable, handled by skipper's who usually have considerable experience of local conditions and, perhaps, with useful anecdotes relating to local seals and the sites they use. Vulnerable equipment can be carried with ease and with great security. Negatives are that trips are made by the exclusive decision of the skipper, and time on site is likely to be limited.

Wave ski/sea kayak

2.40 These craft may be used. They are comparatively slow in passage but otherwise very seaworthy. They are, by far, the most carbon-neutral option; they are the cheapest option; they are very quiet and they are capable of achieving actual landfall at the greatest range of sites of any craft. Where funding is not available for work that needs to be done, it is the sole option for a committed researcher to achieve access and do work that would not otherwise be done.

2.41 Where a comparison be made between these two kinds of craft, although the sea kayak is by far the swifter of the two across the water, the wave ski is preferred, especially where research is being conducted at sea cave sites. Here, if there is swell or surf, the craft may be hurried into the deeps of the cave before landfall is achieved on a beach. Access may be further complicated by hazardous rocks at or below the surface in the approaches, and so misadventure is a possibility. In the event of being rolled by a wave, in rock-strewn darkness, it is likely to be safer to get off the ski rather than wriggle out of the (possibly inverted) sea kayak cockpit. Whether or not misadventure occurs, it is much easier to come ashore and achieve safety both for self and for the craft and the equipment it carries using the wave ski.

2.42 A wave ski is constructed from polypropylene, is virtually indestructible and, where an ankle leash is anchored to the ski, will function automatically as a life raft. The paddle should have a carbon fibre stem, to render it as far as possible unbreakable, and should be attached to the toe loop anchorage points by unbreakable twine so that, in the event of misadventure, it remains attached to the ski and thereby allows the fieldworker to right the ski and resume paddling.

2.43 Field equipment can be secured to anchorage points on the ski.

2.44 The fieldworker can use the wave ski spontaneously, without needing to gather together the team of people required in the use the other forms of transport to and from sites. There are no costs per trip: the cost lies exclusively in purchasing the ski, paddle, ankle leash and spare parts. Such costs are minimal compared with the costs of the hire or purchase of boat time, employing the alternative options.

2.45 Negatives are the prejudices of people who have neither used nor tested wave skis. Being the slowest form of water transport here assessed, far less work can be achieved in a single day compared with every other option. Also, where tide races must be crossed, awareness of rates and timing of tidal flood is much more crucial than with other craft, and in such conditions it is safer to use another kind of craft. Equipment is more exposed and therefore is more vulnerable to damage where this option is chosen.

2.46 More importantly, wave skis and kayaks may cause much more disturbance to seals making use of island or sand flat haul-out sites than noisy, motor-powered vessels (including jet skis) at a distance of 100 metres at many sites (this was observed at North Wales sites including the Tudwals, Ynysoedd y Moelrhoniaid/The Skerries and Ynys Seiriol/Puffin Island). However, if it is possible, as it usually is, to arrive out of sight of the seals at a site, then it remains the most secretive, non-disturbing means of achieving access.

2.47 Wave skis/sea kayaks may be used also to access sites having been launched from RIB's or boats hired locally. While swimming to shore may be considered an option, it is preferable and more sensible to be dry rather than wet when achieving landfall.

Using a wave ski

2.48 The wave ski, constructed out of polypropylene, is a little less than three metres long and about 0.75 metres wide. On the underside, near to the tail, there is a skeg, the length of which can vary between 10 and 25 centimetres, which assists with steerage and general stability. On the topside, there is a hollow for a seat, behind which are two canvas handles. Farther forward, there are two more hollows where the heels rest. Just forward of the heel hollows, there are two padded loops under which the toes rest. Attached to a canvas anchorage point close to the nose of the ski is one end of the ankle leash.

2.49 The ski is propelled using a paddle, approximately 2 metres long, with a carbon fibre stem. It is imperative that the paddle be as near as possible indestructible and that it be made of a material that will not rust or rot. The condition of the paddle should be checked before every trip.

2.50 The paddle is attached by a length of unbreakable line to the forward anchorage point, by means of a bowline knot secured by an extra half hitch, and to the mid-point of the paddle stem by three turns and two half hitches. This is to ensure that if the rider falls off the ski, then the ski and the paddle remain together: there is only one item to retrieve and nothing is left to float free.

2.51 The wave ski can be carried for relatively long distances hoisted on one shoulder. This gives the opportunity to reduce the potential distance to be paddled by gaining access to the sea via footpaths, tracks and even scrambles down to the shore. Carrying the wave ski in such a manner is not a preferred option, especially where the wind is blowing at Beaufort force 4 or more. Then, the 'spare' hand is needed to secure the nose of the wave ski against being violently swung by the wind. Even in quiet weather, carrying the wave ski and other equipment in the dry bags is never a pleasure; but it creates opportunity and may thereby help the fieldworker to spend longer on site taking advantage of the low water window.

2.52 While on the water, the rider is attached to the ski at all times by an ankle leash. One end is secured to the forward anchorage point, the other secured by Velcro around the ankle or just below the knee of the rider. Connection to the ski by way of the ankle leash ensures that if the rider falls from the ski, the two cannot be separated. The ski, being also attached, is easily retrieved. The ski may be upside down but is easily turned the right way up and remounted.

2.53 If the rider falls from the ski close to the shore, connection to the ski by way of the ankle leash means that it could be used as a shield against injury on the rocks.

2.54 Before beginning to use a wave ski, falling off, correcting the ski and remounting should be practised until the exponent is confident in the practise.

2.55 As important as it is that the rider be attached to the ski by an ankle leash, it is equally important to remember to remove the leash when landfall has been secured - to prevent misadventure while walking away still attached to the ski.

2.56 The ski itself is extremely durable, the polypropylene construction ensuring that it is indestructible in the open sea conditions that the fieldworker may encounter.

2.57 Equipment stored inside two sealed dry bags (one being contained within the larger second bag); can be anchored to the forward anchorage point. There, they rest between the legs and serve a secondary function as a partial shield against waves breaking toward the body of the rider.

2.58 The wave ski (and the sea kayak) will be used in only calm or slight to moderate sea conditions and will not be used when the wind exceeds force 4 (Beaufort Scale), onshore, except to return to base or to a safe haven. A safe haven here means the nearest landfall at which the fieldworker can both take refuge and, if necessary, decide to abandon work for the day and gain access to a footpath or road. In practice, this is when the number of white horses becomes widespread.

2.59 Where the wind is offshore, no matter what its force, the wave ski can be used so long as the surface of the sea remains relatively flat, although wave action in such conditions varies between sites depending on what weather systems are active farther out in the Atlantic.

2.60 On each trip, once embarked and c.200 metres offshore, the state of sea conditions should be reassessed, bearing in mind that what appears to be a calm sea from the beach may be a wilder sea when seen from the horizon; and vice versa.

2.61 Don't be brave or foolhardy; be careful.

2.62 Although much local knowledge can and should be gleaned from various local sources, those using the wave ski will gain most confidence if they can compile it out of their own personal experience.

2.63 Summer is the ideal time to begin the compilation of such knowledge, the ideal time to explore those stretches of coast where the most part of their work is to be carried out. The period of several hours around low tide (the length of this period varies according to a variety of factors, principally the phase of the lunar cycle and its effect on the tides) is the best time to explore the area. The period of full spring tides is the time when tidal range will usually be greatest and therefore is that time when the fieldworker has the opportunity to observe the lie of the land and the chance to discover sites where potentially dangerous wave action could occur when the tidal level is higher.

2.64 Close attention should always be given to the nature of the surface of the sea, noting the warning signs of submerged rocks lying close to the surface or where a tidal race begins. The direction and rate of flow should be noted by watching water movement around every fisherman's float passed en route as well as by checking your rate of progress against landmarks.

2.65 Attention should be given to local wind direction and wind speed, especially in relation to the undulations of the coastline, most especially around headlands and below valleys. The nature of any cloud massing along the windward horizon should also be kept under continual review. Whatever any forecast predicts, the fieldworker should remain alert to the realities of the moment. Forecasts are reasonable guesses, not promises.

2.66 Because the fieldworker will be working when sea conditions are mainly calm or slight, there should be no problem in making a comfortable landing. However, if chance intervenes and landfall is hurried by wave action, the fieldworker should avoid colliding with large rocks, be aware that below the low water mark there may be a ledge of variable size and seek to achieve landfall at a point where no large rock disrupts relatively smooth passage up the shore. If necessary, use the paddle to fend of being driven into the cliff.

2.67 It is also important to remember the skeg, or fin, situated on the underside of the ski close to the back end. This is the most fragile (breakable) part of the ski. It is often necessary to paddle through a maze of rocks lying close to the surface, and at such times the skeg may snag on some of them. The choice then is to ease the ski off them by hand, to use the paddle or to dismount and push the ski ashore. It is also possible to become entangled in dense aggregations of algae, especially *Laminaria* and *Himanthalia* species.

2.68 Care should be taken when treading between submerged boulders, bearing in mind that a foot might get trapped or, in extremis, a shin bone broken.

2.69 When heading back toward the sea, such a snagging can render the rider vulnerable to wave action and wipe-out.

2.70 The wave ski gives maximum flexibility of choice regards quiet, independent approach to a site and making quiet landfall. However, there is one significant negative aspect which is that seals may be more disturbed at certain sites (eg Ynys Tudwal West) by the sight of a wave ski being paddled 100 metres offshore than by a jet ski surging noisily by at a distance of less than 20 metres.

2.71 Therefore, it is recommended that, wherever possible, any sighting seals may make of the wave ski should be from a distance greater than 100 metres.

Approaching the site from the sea

2.72 At the outset, notify the coastguard, using VHF radio or telephone, of time of departure, details of craft being used, place of launching, destination and expected time and place of return. Upon returning, notify coastguard of that fact.

2.73 Provide your line manager or another trustworthy person with the same information.

2.74 When approaching the site, the prevailing weather and sea conditions, along with past experience (and site-specific records held in the database), will suggest where the seals are most likely to be hauled out and consequently will indicate where discreet landing may best be made. If it is possible, as with an island or skerry site, to make a wide preliminary sweep, this will prove worthwhile in identifying the location of the main seal assemblies. If this approach is undertaken, it should be done slowly at the maximum possible distance (at a distance of 200 metres plus), to avoid alerting the seals.

2.75 If there is any choice, select the landing place that yields on to the most sheltered approach to the viewpoint you wish to use for your work.

2.76 Timing your period of work is crucial. Normally (ie in the absence of disturbance), maximum numbers of seals at haul-out sites are recorded around the low tide period. You can verify this for the specific sites you are studying with an emergence study - observations at 5, 10 or 15 minute intervals of seals hauling out from the sea - twinned with a re-entry study - observations monitoring their return to the sea. Rarely, there are topographical variables that affect the timing of emergence and re-entry.

2.77 Normally, as the tide rises, seals will either return to the sea as soon as waves start to run against them where they are lying or else they will attempt to shuffle up and away from the sea. These will be site specific behaviours which you could use to the advantage of your work, especially where seals elect to shuffle up the site: this will bring them closer to the cameras (where photo-ID is the objective).

2.78 Where seals are using sea caves, the approaches and points of access are not always as limited as might be anticipated. It is not unusual for seals to use a number of neighbouring caves whose entrances may, at low tide, be joined together by stretches of emerged foreshore. In such cases, approach MUST be made quietly with any recording gear readied for use. In cave entrances, there are often large boulders that offer total or partial concealment for the fieldworker to make a preliminary scan of the interior.

Making landfall on site

2.79 Because the fieldworkers will be working when sea conditions are mainly calm or slight, there should be no problem in making a comfortable landing. However, if chance intervenes and landfall is hurried by wave action, the fieldworker should avoid colliding with large rocks, be aware that below the low water mark there may be rock features of variable size and seek to achieve landfall at a point where no large rock disrupts relatively smooth passage up the shore. If necessary, use the paddle to fend of being driven into obstacles.

2.80 Generally, however, in relatively quiet sea conditions, landfall should be achieved without problems. However, it is often necessary to paddle through a maze of rocks lying close to the surface, and at such times the skeg may snag on some of them. The recommended options then are to ease the ski off them by hand, to use the paddle or to dismount and push the ski ashore.

2.81 If a sea cave is to be entered, a helmet should be worn at all times.

2.82 Particular care should be exercised when treading between submerged boulders, bearing in mind that a foot might get trapped or, in extremis, a shin bone broken. In such a situation, it is wise to move slowly, in particular to avoid becoming entangled in submerged derelict netting or fishing lines.

2.83 Landfall should be achieved quietly and, if possible, out of the line of sight (and hearing) of any seals present on site. It is best to land at one of the edges of the beach or the cave approaches. The time spent on the site is normally unlikely to exceed 15 minutes (including time spent preparing and stowing equipment), but the ski should be lifted well up and away from any tidal action, from being carried out to sea and leaving the fieldworker stranded.

2.84 Once the ski is secured, the dry bag should be opened. If work is to be undertaken inside a cave, the helmet should be donned. The torch and then the camera equipment (including the flash unit) should be readied for use. It is then sensible to move silently as possible along one wall until the first seal comes into view, at which point it is best to be in a crouching stance - the idea being to offer the least human profile to any seal which make happen to be glancing at that moment toward the entrance.

2.85 The line of retreat is of paramount importance at all times, but never more so than in these situations.

2.86 Then, it should be assumed that the fieldworker might be on site for as much as 3 hours. The plan may be to spend only fifteen minutes on site, but distractions or even accidents may occur which cause you to remain for much longer. Despite its importance, it is easy to forget the wave ski and the tide creeping up the beach toward it.

Initial site examination and recording: a pre-visit visit

2.87 Ideally, all fieldwork should be undertaken by a maximum of two people.

2.88 Prior to beginning the monitoring of seals at any site (eg sea cave, ‘open’ beach, island) known to be used or to have been used in the past, an initial reconnoitring visit should be made. The purpose is to draw up an annotated plan view, supplemented by photographs, of the site and its features so that all future visits can be made in full knowledge of the salient features of the site and with regard to minimising disturbance caused to the seals.

2.89 The annotated plan view must always include:

- Site name.

- Site reference number.
- Ordnance survey six-figure co-ordinates.
- Site length and width.
- Description of the substrata.
- Orientation of the site.
- Notes describing places where seals might be overlooked by ‘unseen’ observers, such as small tunnels leading off the main fairway of the cave.
- Description of both obstacles and aids to comfortable movement on site.
- A photograph of the site taken from the sea, showing it in relation to an unmistakeable topographical feature or the adjacent coastline - particularly valuable where two or more caves share the same OS six-digit reference number.

2.90 Points of access to the site from the land will be marked on the plan view and categorised as easy or difficult:

- Easy describes access via a footpath, track or easy scramble.
- Difficult describes access by clambering or abseiling.

2.91 Where access is by boat:

- Easy describes access where there are few or no obstacles in the sea approaches and where it may be possible to beach the boat.
- Difficult describes access via rock-strewn approaches and where sea conditions are in some way hazardous (eg influenced by the narrowness of the approaches, by wave action or by tide races).
- Access by rigid-hulled inflatable boat (R.I.B), canoe or wave ski requires that the nearest launch site be identified by:

1) Name.
2) Ordnance Survey six-figure co-ordinates.
3) A description of the launching facility must be given including whether or not the site dries out at a certain state of the tide, whether and from where permission to launch needs be sought, where is the nearest source of boat fuel.

- Local sites where refuge can be taken in an emergency should be identified.

Human activity

2.92 It is imperative that site access be achieved with maximum discretion and quietness, to avoid drawing the attention of people in boats, on beaches and footpaths to it and to keep the potential for causing disturbance to the seals to a minimum.

2.93 The variety and intensity of human activity in the vicinity of the site through the seasons must be monitored, described and evaded as a component of the research effort during every site visit, in order to help assess trends in pressures on sites as well as to maintain its security.

Gaining access to sites down cliff faces

2.94 As described above, sites may be reached from the sea or else by relatively easy access from the land during which no special equipment is required. However, especially at sites in south west Wales, it may be preferable to access sites by climbing or abseiling.

2.95 Equipment required for abseiling (from Skomer MNR Monitoring Handbook):

NB. Climbing/abseiling should be done only by people with appropriate training.

(All equipment can be carried in a large rucksack.)

- Climbing rope;
- Climbing harness;
- Helmet;
- Clogger;
- Ascender;
- Figure of eight;
- Several carabineers;
- Torch;
- VHF radio;
- Mobile phone;
- Whistle;
- Pack of flares; and
- First Aid kit.

2.96 In sea caves, two torches should be carried, with one serving as back up. Little can be achieved there without illumination. A flash unit will be essential if a SLR camera is to be used.

Working on site

2.97 At all times, it should be remembered seals have an excellent sense of smell and excellent hearing. Their eyesight is excellent in the recognition of moving objects, even those briefly glimpsed out of the corner of an eye and even at considerable distance. Once a movement has caught their attention, they keep returning their attention to that place, even after they appear to have re-settled to sleep.

2.98 However, when objects are not moving, the seals may show less or no interest. At such times, a seal may 'look at' a fieldworker and fail to recognise that person as a human being - as a threat or an object fit for continuing interest. When they are uncertain about what they are seeing, it is apparent that they seek information from their other senses: they try to smell and listen to the 'object' they are examining, while still craning their necks and attempting to use their eyesight.

2.99 At all times, it should be remembered that seals tend to be restless while hauled out, most especially when first hauled out and still wet. At this stage, they will be observing seal etiquette - seeking to avoid causing disturbance to other seals - while seeking a settled resting place. Settling to rest takes time. It is accompanied by much peering about them, shifting of position, inter-actions with near neighbours and a general shuffling up and away from any wave action.

2.100 The problem of alerting seals is considerably complicated by any attempt to approach a group of them. Approaching a group of seals may be likened to approaching a hydra-headed organism. To alert one seal can easily lead to the alarming of the entire assembly. Furthermore, once a seal has had reason to come to the alert, it will remember the direction that the disturbance came from and will keep glancing that way even when a considerable period of time has elapsed and even though they appear otherwise relaxed (see above). In the same situation, other individuals appear to settle and relax, except that their eyes continue to open narrowly, periodically, watching the point where the movement that had alerted them had been first noticed.

2.101 Therefore, whenever fieldworkers approach and work on sites used by seals, the fundamental imperative is that the acuity of the seals' senses be respected. Failure to do so will cause disturbance. Typically, seals hauled out on islands or skerries will stampede into the sea. Seals in sea caves will stampede into the sea, into tide pools or may retreat deeper into the cave.

2.102 The ideal is that any approach to a seal site will be undertaken unseen and unheard by the seals. It will not always be possible to take equal account of their sense of smell, but where possible, any approach should be made into the wind.

2.103 Under most circumstances, rigorous effort must be made to avoid causing disturbance during survey work because if we cannot set and maintain the highest standards for ourselves, in this as in other fields, then we are ethically hampered in requiring that others show due respect for any anti-disturbance measures need be applied in order to manage marine Special Areas of Conservation and other protected areas.

2.104 The question arises, however, whether it is always possible to avoid causing disturbance and, at present (in the absence of remote sensing devices being used to collect data), situations will continue to arise which do cause disturbance in three areas in particular. The first is where we are attempting to locate and count seal pups. The second is where we are attempting to record abundance counts for seals at sea cave sites. The third is where we are making photographs of individual seals for identification purposes.

2.105 Approaching seals and getting your work done is half a story. The hardest part entails removing yourself from the site once the fieldwork has been done without causing disturbance. That means crawling slowly, irregularly, and backwards until you find yourself in a place of concealment where you can turn yourself around.

Using fieldcraft

2.106 When monitoring seals ashore, (some) potential disturbance can be avoided if intelligent field-craft is used.

2.107 Consider how stalkers approach red deer. Approaching seals is a variation on the same theme: move in the manner that might be employed by an aboriginal being, combining an awareness of the position of the seals with physical fluency in slithering over the rocks and through the tide pools - remembering that not only your body but your essential recording equipment requires protection against splashing, immersion and bumping. Remember what lies behind you and ensure that you are never offering a recognisably human profile.

2.108 Most particularly, distort the shape of your head and conceal the brightness of your face. Adapt a wet suit, reinforcing the knees and elbows, padding the torso. No matter how ridiculous you may think you look, construct appropriate headwear: sew fronds of seaweed on to a hat - back as well as front, because there will be times when seals lie behind as well as in front of you in a rocky environment.

2.109 The foremost complicating detail when attempting to approach seals hauled out on rocky shores is that very often they are not gathered in one locality alone. There may be several groups at points around the site, as well as the occasional solitary seal resting alone. This can render unobserved approach impossible. At such times, the fieldworker has to make a choice:

- Disturb a lone seal in order to reach a desired point of proximity to a larger group of seals.
- Disturb a small group of seals in order to reach a desired point of proximity to a larger group of seals.
- Abandon the site in order to avoid causing disturbance.
- Accept that disturbance is inevitable, as is likely with photo-identification work, and be prepared to accelerate the capture of images if it begins to happen.

2.110 The time that every observation session begins and ends must be recorded.

Using a hide

2.111 For sites where there is inadequate cover to allow close approach to seals, as at the Longships Reef off Lands End, counts must be made at long-range - from the Cornish mainland shore - or from boats.

2.112 Where behavioural studies are to be made in the absence of adequate cover, for example monitoring pup development at a nursery site, a hide must be deployed.

2.113 As previously asserted, every effort has to be made by fieldworkers to remain invisible to the eyes and inaudible to the hearing of seals, in order to avoid initiating actual disturbance events but also to keep to the minimum disturbance to the atmosphere of the entire site. This may appear a somewhat bizarre requirement, except it must be remembered that we are always merely fleeting visitors at seal sites and it is not uncommon for seals to peer in the direction even of concealed observers, supplementing their 'search' by sniffing the air, clearly demonstrating that they are sensitive to a change in the atmosphere. Therefore, it is wisest not to talk or else to talk in muted whispers, so acute is the hearing of the seals, and to make as few movements as possible.

2.114 In practise, this entails establishing the lie of the land: a preliminary awareness of the terrestrial sites and the water areas used by seals and of their lines of sight to wherever a fieldworker might have to walk in order to access the hide. It means wearing dull-coloured clothing, keep the head down so that the brightness of the face is as little apparent as possible, walk slowly using a shortened stride and a hunched up posture. Wherever possible, it was thought best to walk close to topographical features that offered some measure of camouflage, such as rocks and slopes, and to avoid walking across open spaces except where absolutely necessary. Where necessary, be prepared and, if necessary, dressed to crawl over terrain likely to be damp.

2.115 The initial erection of a hide can only take place when wind conditions allow - that is, when wind force is Beaufort force 5 or less. Erection should take place while seals are absent from the site. Whenever possible, hides should be erected and immediately thereafter, the fieldworkers should depart the site, leaving the hide to become - from the point of view of the seals - a natural part of the topography, unrelated to human activity.

2.116 Hides are particularly useful as a vantage point from which to make extended behavioural studies and to conduct photographic exercises. However, additionally, they create blind spots for the seals by obstructing certain lines of sight and thereby allowing movement by fieldworkers across spaces that would otherwise be off limits.

2.117 During the approach to and departure from making observations from the hide, where is the choice, bedrock or greensward should be trodden on rather than loose stones or small boulders, because this allows the least noisy progress to be made. Where fronds of seaweed are spread over stones or the smaller boulders, these serve to deaden sounds made by footsteps. If it was necessary to wade through tidal pools, it was better not to lift the feet up out of the water with each step but to glide along slowly, thereby making the least water sounds.

2.118 When in position to make observations, continuous effort must be made to avoid startling the seals. Flaps snapping in the wind when unsecured attract the attention of the seals, sun glints on lenses, all sound carries. The door flap should be closed so that the observer is not silhouetted against the light behind while making observations.

2.119 The hide recommended for use at the time of preparing these guidelines is a standard dome hide with a camouflage pattern.

2.120 The hide measures 1.3m (4'4") at the base, 1.35m (4'6") high at the centre. It is held erect by 2 aluminium flexi poles and, if not being moved, by pegs and guy ropes. Construction is of polycotton and it is mainly, but not completely, weatherproof. It is freestanding and can be walked about the site with the observer remaining inside as it is both lightweight (2.7kg) and does not

have a groundsheet. However, in winds of force 4 or more, if the hide is not pegged down, it becomes very difficult to work and hold the hide braced against the wind.

2.121 It is described as having plenty of room for one person and a stack of gear, but there is room for two people. In such situations, the comfort of both people is imperative.

2.122 It has one front window and two side windows. All windows are large enough to put a long lens through. All have a material flap and an insect net. The front window also has a scrim net. There is also a tripod flap at the front. There is a central back flap with overlap, Velcro tabs and tie cords. A long lens can be put through the tabs between the Velcro tabs.

2.123 In addition, there is a turn-up all around the bottom inner edge of the hide, into which sand or earth can be piled to weight down the hide during windy conditions. It is important that whatever is to be used is left in place from the outset of the survey period, as this is one of the marginal details that is easily put off or neglected. Only when the wind speed rises does it cease to be a marginal detail, at which point the fieldworker may struggle to keep the hide standing.

2.124 Guy ropes should be set in place at the outset, whatever the weather. Experience suggests it is important to have two spare sets of guy ropes and two spare sets of tent pegs, both with a selection of peg lengths. In addition, if there are any flat, heavy, stone slabs in the vicinity, store them by the four corners of the hide, to be rested on the pegs at need.

2.125 However, where wind speed exceeds Force 5, unless it is erected in a sheltered spot, it should be taken down. Again, reference to the weather forecast is important. Ideally, it will be taken down before the big blow arrives.

2.126 Equipment should be carried in a Lowepro dry case, which can function subsequently as a seat while observations are being made or photographs taken.

2.127 The type of hide described here is preferred to a long and low dome hide because it permits a more elevated viewpoint of the seals and allows the observers greater comfort for the long periods during which they may be working.

3 Procedural guidelines: seal pup production

3.1 All on-site work must be carried out by a specialist unit, having obtained all relevant licences from Natural England, and been trained to cause least possible disturbance while collecting the data in the quickest possible time (having first established the timing of the season of pup production for the locality being surveyed). Due to the specialist nature of this work this section has been removed from the general guidelines but can be accessed by contacting Natural England.

3.2 Checklist of data to be gathered:

- Timing of site visit.
- The season of pup production.
- Monitoring pup production.
- Some potential negative aspects to be considered when trying to estimate overall pup production.
- Locating pups at sea cave sites.
- Assessing the age class of pups.
- Detail of protocol for site visits/watches.
- Dye-marking.
- Locating pups at 'open' beach sites.
- Measuring disturbance caused by the research effort.
- Ameliorating disturbance caused by the research effort.

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045

4 Procedural guidelines: distribution & abundance

Introduction

4.1 So far as possible, data from island, skerry and beach sites should be collected by remote observation, thereby rendering disturbance of the seals unlikely.

4.2 A specialist unit, trained to cause least possible disturbance, should carry out all on-site work.

4.3 Checklist of data to be gathered:

- Count number of seals.
- Distinguish the sexes and estimate number of immature seals (see below).
- If time & circumstances permit, note position (with sex & age balance) of seal assemblies.
- If circumstances permit, photo-ID adult seals present.
- Note any human activity in the vicinity of the site - whether the site or seals are subject to disturbance.
- Is the site polluted or a sink for litter?

4.4 The largest numbers of seals to be found assembled in sea caves are found between the months of (late) November to the end of March, when the annual moult is taking place. This is likely to be that time of year when the heaviest seas are beating upon the shores of the southwest.

4.5 At this time, the assemblies are either single sex with seals of all ages, or there will be predominantly one sex with a very few individuals of the other sex but otherwise the full span of ages.

4.6 The main behaviour of the seals at this time is sleep. However, very young seals, in the first year of life, may be present and, if so, may be actively playful. They may play a game that resembles ‘tag’ through the maze of slumbering hulks that the adults resemble. Where they brush against their elders, this sets off mildly aggressive reactions, varying from growling and wailing to flippering and snarling. The fieldworker should be extremely wary of this behaviour, partly because inevitably it makes the adult seals become more alert and partly because the extreme response to disturbance by the youngsters is to set off a stampede of the full assembly of seals toward the cave entrance.

4.7 The largest numbers of seals assembled at haul-out sites probably gather in June or July, being dependent on sea conditions.

Protocol

- The time that every observation session begins and ends must be recorded.
- Identify each haul-out site by OS co-ordinates. Draw a plan view of each site, noting all cave features including the direction in which the entrance and, if relevant, the approaches to that entrance are orientated. Photograph the cave entrance in relation to the adjacent coast so that where cave entrances are close together, one cave cannot be mistaken for another. On the plan view of the site, indicate points, types and ease of access available from the land and monitor level of use by people.

- Identify and monitor sites which have the appearance of potential haul-out sites which may have been used in the past or else lie adjacent to the site or sites currently being used.
- Having first made the count of seals present, set the camcorder running prior to any photo-ID effort.
- Mark, on a copy of the plan view of the site, the positions where seals were observed, noting their sex.
- If possible, photograph the two profiles and head-on view of all seals present at the haul-out site (to be entered in the main catalogue and a separate site specific catalogue).
- Record the incidence of seals entangled in netting and seals with injuries or distinctive scars.
- Where dead seals are found, they should be tagged, using bright-coloured plastic ties such as were used during the 2002 phocine distemper epizootic, to ensure they are counted only once. These can be obtained from the Marine Mammal Strandings Network. Remove the corpse from the site if so required by the Marine Mammals Strandings Network.
- Record types and levels of litter found at the site and film or photograph impacts on pups.
- Indicate types and levels of human activity in the vicinity of the site, noting current levels of seal disturbance.

Background

4.8 The Sea Mammal Research Unit (SMRU) has the responsibility to advise the government about seals and fisheries. As a major component of the effort to fulfil those responsibilities, SMRU carries out annual aerial surveys of grey seal nursery sites during the season of pup production, with photographs of the sites being taken and subsequently analysed at the laboratory to determine pup numbers.

4.9 Traditionally, grey seal population estimates have been determined by extrapolating out from the estimated pup production each year using a model incorporating what is known of seal life histories. Very crudely, the population estimate was achieved by multiplying every pup by 3.5 to 4. However, this is problematic insofar as models are lacking in detailed information about, for example, the number of sexually mature females that are (or do not become) pregnant and the number that die during pregnancy.

4.10 However, no effort has been deployed by SMRU to determine the number of pups born at southwest England sites since 1981 (Prime). That expedition was very substantially disrupted by sea conditions and by lack of knowledge about the timing of the season of pup production, about the location of nursery sites and even about what constituted a nursery site - insofar as at that time, it was believed that at the sea cave sites - which form a substantial majority of sites used on the southwest mainland, then as now - required that there be some sort of beach available to pups even at high tide. This is not the case (Westcott, 2002).

4.11 Therefore, there has never been what could be described as an accurate population estimate, nor any kind of indication of year-round site use, made for the seals of southwest England, despite the fact that it might have some bearing on the long-term conflict between seals and fisheries in the region. Indeed, neither has it been described previously for the region what exactly is understood by the term ‘population’.

4.12 Year-round research has been carried out at sites in North Wales between 2001 and 2005 (For example. Westcott, 2002; Westcott & Stringell, 2003), where there is a similarity apparent to the range of sites used by seals in southwest England. Here, it was found that no sense of ‘population’ size could be derived by extrapolating outward from pup production estimates. Rather, simply, there were counts giving an indication of site use over an extended period of time. In this situation, identity is important. Photo-identification would help to elaborate what was being indicated by the simple ‘age & sex’ counts.

4.13 Year-round site studies give coastal managers a clearer perception about grey seal abundance than statistics-based population size extrapolated from pup production studies (being based on

the study conducted between 1994 & 1996, Westcott: see Appendix 2). They also contribute to perceptions of seasonal movements by seals. This was noted, also, by Kiely et al (2000) when examining seal distribution and abundance at sites in southwest Wales and southern Eire.

Timing of the site visit

4.14 Sites should be visited around the time of low tide, or (preferably) not more than 90 minutes before or after low tide.

4.15 This is the period when seals are likely to be ashore in maximum numbers (Goodchild, 2003; Westcott and Stringell, 2004). There are a few sites where this does not hold true. If in doubt, before beginning the fieldwork-proper, carry out a study of the rate of emergence of the seals from the sea over one full tide cycle, preferably on a spring tide.

Working on site: in detail

4.16 The principal objective when studying the abundance of seals at any site is to make accurate counts of the number of seals present around the time of low tide, or at that time when the assembly can be expected to be at its maximum size.

4.17 In making the count, the numbers of males, females, juveniles (small, sexually immature seals) and unidentified seals (meaning that they are too far distant to be accurately identified or that the sex is not clearly apparent) should be recorded.

4.18 Additionally, photographic identification images of individual seals should be captured whenever possible.

4.19 However, before the fieldwork begins, it is imperative that an initial site reconnaissance is carried out in order to:

- Identify where and when seals are hauling out, mindful that seals exhibit differing haul-out patterns and use different resting places during neaps as compared with spring tides at some sites (Westcott, 2000).
- Identify where seals rest in the adjacent waters.
- Identify secluded viewpoints from which data can be collected and film/photographs taken.

4.20 Despite the apparent availability of the entire site, grey seals tend to return to the same localities on that site. The only variation in this pattern of behaviour is caused by wave action, which may cause them to prefer only the lee shore options. For the fieldworker, knowing the likely haul-out locality of the seals will be crucial in determining how to approach the site and what route to choose when on-site.

4.21 It will also be apparent that although many seals of both sexes use some sites, they may be assembled in a number of groups and that a number of such groups consist exclusively or predominantly of seals of one sex. This detail should be recorded and, should the pattern of the assemblies be fixed, that should be noted also.

- Capture photo-ID (head-and-neck) images of individual seals, for entry into the EIRPHOT catalogue. (See below: ‘Seals at nursery sites’.)
- Capture a video record of the entire photographic period.

4.22 It may prove impossible to keep a spoken or written record matching left and right profiles of individual seals, especially where they are present in a group of more than 15 and more especially if the seals are moving.

4.23 The only safe way of achieving accurate matching is to film the entire sequence, setting the camcorder on a tripod and leaving it to run throughout the observation period. At the end of the day, at base, the video record will clarify which left and right profile combinations belong to which seals.

- Indicate types and levels of human activity on or in the vicinity of the site, noting levels of disturbance to the seals.

4.24 Additional data that could be collected include:

- The incidence of seals entangled in netting and seals with injuries or distinctive scars.

4.25 This allows for more immediate identification of seals, without reference to the photographic record.

4.26 However, wherever an 'entangled' seal is recorded, a photographic image should be captured, to ensure that multiple counting is not taking place.

- Recording dead seals, tagging them and, if necessary, removing them from the site (following methods advised by the Marine Mammal Strandings Network) plus post-mortem studies to determine cause of death where possible.
- Monitoring types and levels of litter found at the site and film or photograph impacts on seals.

4.27 Tidal sites are likely to be washed clean of litter. However, sea caves appear to act as a magnet for litter. Despite the violence of the sea conditions inside sea caves during stormy interludes, once deposited there, litter can have a very long period of residence. If litter is being researched at seal sites, it should be marked so that residence time can be measured.

4.28 Other litter, especially derelict fishing gear, is often driven into cracks at the back of sea caves.

4.29 Depending on the type of substrate, beaches may also retain litter for extended periods.

- It might be wise to carry a stick on site, both to help maintain balance on a surface that is often slippery or potentially mobile and for use in making rough measurements (of the site or of the corpses of marine mammals discovered stranded there). It can be divided into specific lengths by the use of electrician's tape.

Measuring disturbance caused by the research effort

4.30 It is recommended that a detailed activity budget examining seal behaviour and their responses to different levels of disturbance by fieldworkers at a sample of sites be carried out during the course of the survey and by observers not involved in the survey, in order that subsequent site visits can be modified appropriately.

Ameliorating disturbance caused by the research effort

4.31 The simplest option for avoiding causing disturbance is to make remote observations. For example, use a telescope for making observations from an off-site vantage point.

4.32 The most expensive way of avoiding causing disturbance to the assembled seals is by making an aerial survey, at a height of 200 metres or more, and taking photographs of the seal assemblies using a camera with 150mm lens.

4.33 If there is no option but to work on-site, then distribution and abundance research - the making of counts - can very easily result in at least some of the assembly of hauled out seals being disturbed into the sea. Therefore it is extremely important that good fieldcraft be standard practise at all times in the field, whether on site or not.

4.34 However, before the fieldwork commences, if the site is being approached via the sea, firstly it should be circumnavigated at a distance of a least 200 metres to ascertain that the seals are where you expect them to be and to locate the most favourable blind-side landing place available. The distance proposed is that at which disturbance will not result.

4.35 The principal reason that seals are likely to be disturbed (after the use of poor fieldcraft) is that they often use ‘different rooms in the hotel’ - they gather in groups at different points (often) around the fringes of the site. They are conservative in site choice and also repetitive. This allows them multiple viewpoints and opens the near certainty that it will be necessary to cross the field of vision of one group en route to reaching the viewpoint from which an accurate count of another group can be made. The twin of that possibility is that once you are in position making observations at your chosen viewpoint, you forget the presence of the other seals.

5 Procedural guidelines: disturbance

Introduction

5.1 Preparation prior to any disturbance study should be carried out with utmost discretion and without public announcement.

5.2 In order to accurately study disturbance events, secrecy is imperative because it is naïve to expect people knowingly being observed to behave the same way as they would when unobserved. That being the case, it is sensible to tell no one at all, except those from who permits are needed and those who are providing funding.

5.3 Any disturbance study which may in itself cause some disturbance, must obtain all relevant licences from Natural England.

5.4 In order to recognise disturbance caused by human activity, the first imperative is to determine what constitutes normal behaviour for the seals assembled at the site where the issue is under examination. This can be achieved by observing the rate of seal emergence from the sea and by studying their behaviour using activity budgets.

5.5 There are many descriptions of disturbance. In this instance, the disturbance to seals that research is designed to reduce or prevent is:

- When ashore, seals are frightened into the sea by the passage or approach of people.
- When ashore, seals are frightened to the point that they mill and become involved in aggressive encounters with their neighbours.
- When in the sea, seals are caused to crash dive by the passage or approach of people.

5.6 In each case, seals are triggered into entering the sea at a time not of their choosing by human activity in the vicinity of the haul-out site.

5.7 It is imperative that the survey design and the discussions that must ensue are scrupulously fair (that is, not a witch hunt) and without inherent prejudice (for example, at the present, there is widespread dislike of jet skis and the way they are used).

5.8 In particular, it is imperative that the survey is designed to achieve results that will inform the discussions that follow the fieldwork between the coastal managers and representatives of the boat operators. Ultimately, accord about any proposed measures is most likely to be achieved with a light touch, a least interference with personal freedoms to roam and ultimately a desire to contribute to a general reduction in disturbance levels at the sites in question.

5.9 Checklist of data to be gathered:

- What constitutes normal seal behaviour at this time of year for the site in question?
- How many seals use the site every day?
- What is the identity of the seals using the site (photo-ID)?
- What are the sources of disturbance to seals ashore at the site and in waters adjacent to the site? Notes should be made on every site visit (for whatever purpose) describing a general impression of current levels of seal disturbance. Notes to be recorded only in the event of seals being disturbed into the sea.

- How many people and how many and what types of boats pass within 50 metres of the seal haul-out site every day?
- How often are seals disturbed into the sea (or crash diving where they are in the sea already) every day?
- The time of the start and conclusion of every session of observation should be recorded.

Protocol

5.10 An initial pre-survey site reconnaissance should be made around the time of low tide, in order to draw a plan view of the site. It is important to measure distances at this time, not only ashore but from features on the sea (such as crab pot markers) to shore in order to inform assessments of the distance boats are situated from the seals.

5.11 The reconnaissance should identify the parts of the site used by the seals in different environmental (mainly wind direction and speed) conditions. This will contribute toward identifying viewpoints from which observations are best made, according to the environmental variables.

5.12 Observations should be made, where possible, from concealed viewpoints.

5.13 In the design of survey sheets, avoid over-elaboration (for example, of the range of seal behaviours). In essence, when ashore seals will be engaged in seal-seal interactions or will be at rest, be alert, be poised to flee or will be fleeing into the sea.

5.14 In addition to the use of survey sheets, all disturbance incidents should be captured on video film. Alternatively, the sequence of events culminating in the act of disturbance and its aftermath should be photographed. This generates specific evidence of the encounter that may be useful in demonstrating sensible and sensitive approaches to and departures from seal sites as well as that time spent adjacent to the site. It can equally eloquently describe unwise and improper approaches to, time at and departure from seal sites.

5.15 Film and photographic sequences can also be of use in describing normal and disturbed seal behaviours.

5.16 Questionnaires are an important element in helping gauge public awareness of and reactions to the disturbance of seals and its management. Public opinion is one important component in efforts to achieve the implementation of recommendations for the mitigation of disturbance. This would be particularly important, for example, where boat operators are carrying members of the public to view the sites where seals assemble.

Initial site reconnaissance(s)

5.17 Identify where and when seals are hauling out, mindful that seals exhibit differing haul-out patterns and use different resting places during neaps as compared with spring tides at some sites (Westcott, 2000).

5.18 Identify where seals rest in the sea adjacent to the site, bearing in mind that seals appear to be as faithful to the water resting places as they are to sites ashore.

5.19 Identify secluded viewpoints from which data can be collected and film/photographs taken, both on- and off-site.

5.20 Identify (sea) distances around the site. In this, rocks, crab pot floats and navigational buoys are likely to offer the best help. The site should be measured.

5.21 Identify, if possible, the harbour(s) of origin as well as the names of boats seen in the vicinity of the site.

5.22 This will enable the project designer to draw up site-specific survey sheets (For samples, see below, bearing in mind that amendments may need to be made to each list in order to reflect variations between sites). It is sensible to add to the number of sheets a plan view of the site on which special events and the time they occurred can be recorded. This will help the fieldworker when writing up notes in the evening. It can also be used to insert times of arrival and departure from sites by individual seals, where seal numbers are sufficiently low that each individual can be identified.

5.23 At this stage, a decision will be taken as to the intervals between observations. The potential range of intervals is between 2 and 10 minutes being dependent on:

- The size of the seal assemblies. How much an observer can be expected to observe accurately at the interval chosen? The more seals there are, the longer they will take to count or scan.
- The objective of the study.

5.24 In addition to recording data on the activity budget sheets, a notebook or Dictaphone should be used to document other details and thoughts, including those concerning the amelioration of impacts even as they occur.

Fieldwork

5.25 The ideal number of fieldworkers is 3: one to record seal behaviours, one to record human/boat behaviours and a ‘libero’ who operates the cameras and captures the sequences of events leading to gross disturbance. The tasks should be alternated.

5.26 No one (seal or human) should be aware that the study is taking place. Therefore, it is crucial that fieldworkers remain, as far as possible, invisible while occupying the optimum viewpoint from which to make observations. Effort must be made to arrive at the viewpoint unseen by seals or humans. Arrival should occur before the first seal has hauled out. Departure should occur at least 15 minutes after the last seal has entered the sea.

5.27 Concealment may be achieved by the use of:

- Natural features, such as rocks or stands of vegetation, especially tree mallow.
- A hide.
- Camouflage, perhaps using a light coloured sheet similar in colour to the surrounding area, using a mobile screen or wearing cryptic clothing. In all circumstances, padding is required for back, bottom, knees and elbows.

5.28 The survey begins as soon as the fieldworkers are settled on site, around the period of low tide. In most cases when not disturbed by humans, peak counts of seals are made at and just after low tide (Westcott & Stringell, 2005).

5.29 Observers will record the ‘main’ seal behaviours at regular intervals (of 2-10 minutes). In essence, they are looking for four principal types of behaviours: asleep or relaxed, alert, active or alarmed.

5.30 Records should be kept of wind direction, wind speed and sea state, in order to discover to what extent they might influence site choice around the bay.

5.31 Anecdotal accounts of the differences in seal behaviour over the years should be sought from local people, especially inshore shell-fishermen, to see if it is similar to that revealed during the survey.

5.32 The natural pattern of grey seal emergence from and return to the sea at the site should be recorded at interval of 5 to 15 minutes through the tide cycle, in order to recognize the natural

5.33 A count of seals in the sea adjacent to the haul-out sites should be made at the same time.

5.34 Simultaneously, instances of human activity at or near the site should be recorded at the same interval.

5.35 The time of arrival and the duration of time stayed at any moorings adjacent to the site should be recorded.

5.36 Seals in the sea show ‘disturbance’ by crash-diving. Thereafter, they bob up, almost always farther from the source of the disturbance, and ‘stand’ there, observing the source of the disturbance.

5.37 Events from which gross disturbance resulted should be recorded at the time they happen, using a camera or a camcorder.

5.38 The presence of seals readily identifiable because they are wearing flipper tags or collars of netting should be noted. This represents a very small-scale prelude to identifying every individual seal, in order to understand the effect of disturbance on individuals as well as groups of seals.

5.39 The weakness of the method is that the seal might have hauled out at other nearby sites during the survey period without being identified.

5.40 Increased vigilance (behaviours including lifting or turning of heads in response to human behaviour, prolonged watching of people or movement away from people without entering the sea) was not quantified during this survey because of time and personnel constraints. Had it been studied, this behaviour would have been categorised as minor disturbance.

5.41 Records were made of wind direction, wind speed and sea state, in order to discover to what extent they might influence site choice around the bay.

5.42 In practise, it is almost inevitable that visiting breeding sites, especially sea cave sites, will cause some measurable disturbance of seals, either due to seals becoming aware during approach made to the observation point (noise or movement) or when photographic data is being collected (illumination and the sound of the shutter release being operated).

5.43 However, there are ways of keeping potential disturbance to a minimum.

5.44 It should be a standard operating procedure that as much preparation as possible be done from without the site - before the seals have the opportunity to become aware either of the intrusion or at least of some change in atmosphere that causes them continuing unease.

5.45 This can include checking the lie of the land and planning the route to be taken, noting features that will serve to keep the fieldworker concealed from the seals, as well as noting whether there are any pools within. If there are no pools, then there is no need to carry the equipment in waterproof containers.

5.46 It will include seeking to locate the seals (by the sounds of their breathing or their vocalisations, as well as by sight). This will help the fieldworker decide what equipment will best serve in the specific conditions.

5.47 If the SLR camera is to be used, attach the lens and the flash unit. Check how many shots remain on the film. Have spare film readily available.

5.48 If the digital camera is to be used, check that the battery is full and, if not, check that the back-up battery is readily available.

5.49 If the camcorder is to be used, check that the battery is fully charged and that the back-up, along with a spare mini-DV tape is readily available.

5.50 Whatever photographic equipment is to be used, make sure that you are carrying a damp chamois leather in a re-sealable plastic bag, in order to wipe misted lenses.

5.51 Thereafter, the fieldworker should enter the cave and move to the point of observation.

5.52 If there are two fieldworkers, there are two options:

1) The two fieldworkers remain very close together - in effect, offering just one hostage to fortune, to be seen by the seals within. Entry to and exploration of the cave should, ideally, be along a wall, thereby minimising the 'human' profile and also offering the widest possible escape route to seals stampeding toward the sea. It is important to remember to depart equally discreetly. The minimum time (the minimum period of potential disturbance) should be spent at each site.
2) The two fieldworkers separate. In this case, it is envisaged that one should walk into the cave, working as close as possible to one of the walls, working to remain concealed, as described for the first option. The other should wait on the opposite side of the cave, near the entrance. The principal reason for this relates to photographic effort.

5.53 If the fieldworker proceeding within is on the left side of the cave and if the seals within stampede toward the cave entrance - this being one of three likeliest options (the other two being that the seals move deeper into the cave or they do not move at all) - he will have the opportunity only to photograph the right profiles of those seals, whereas the fieldworker near the cave entrance will have the opportunity to photograph the opposite profiles as the seals pass by.

5.54 Of these two options, the second is recommended.

Identifying and capturing acts of gross disturbance

5.55 In the sea, seals signify that they have been disturbed by making a noisy crash-dive, with the dive being preceded oftentimes by a powerful snort expelling air through the nostrils. Underwater, typically they may make a getaway at speed that, in shallow water, leaves a ream at the surface betraying their passage.

5.56 On land, a mild reaction has them coming to the alert and staring toward the source of the disturbance. However, this could also be regarded as the 'tripwire moment', in that if a boat continues to approach a seal that has come to the alert, at the conclusion of the encounter, the seal is almost certain to be disturbed into the sea.

5.57 A moderate reaction is where the seals are stimulated to move on site, perhaps to the edge of the sea.

5.58 A gross reaction is where the seals stampede into the sea.

5.59 The 'libero', using camcorder and a SLR camera with zoom lens, can remain alert by compiling a record of normal behaviour by the seals.

5.60 During periods when disturbance appears imminent, the 'libero' should film the sequence of events while seeking to remain well concealed until any boat and its crew are committed to the actions that result in disturbance. This will furnish proof-positive not only that the event took place but also who caused the disturbance. Coastal managers may choose, subsequently, to compile video handouts in support of codes of conduct to help in the amelioration of future avoidable impacts upon the seals.

Monitoring disturbance via web cams

5.61 An alternative to direct visual surveillance of seals is to use web cams to monitor a site.

5.62 At sensitive sites, this would generate more examples of natural and disturbed seal behaviour while also contributing toward the cost of establishing the surveillance. It might also serve to monitor daylight activity by seals and serve to identify where current disturbance management efforts are failing. They can also supply images of disturbance useful to managers who wish to use examples of disturbance in video presentations.

5.63 The use of web cams will be of particular use if conditions permit their erection at remote sandbank and island sites. There is only one such sandbank site in Wales: the West Hoyle Sandbank, just to the north of Welshman's Gut at the entrance to the Dee Estuary, adjacent to Middle Eye by Hilbre Island.

Sample survey sheets

Rationale for survey forms design

5.64 Where the objective of a study is to identify if, when and where human disturbance of seals is taking place, it is unnecessary to prepare elaborate activity budgets. We need only to identify seal behaviour that is in response to human activities. In addition, this will be influenced by the number of seals present at the site under observation.

5.65 Where a seal is present on site, 'natural' behaviour (that is, undisturbed by human activities) could be said to fall into a minimum of 5 categories: asleep or relaxed; alert or vigilant; moving; inter-acting with another seal or hurrying into the sea. Here, detail of seal-seal inter-actions is not of primary interest, except where the first seal to react to a disturbance stimulus sets off a stampede by the remainder of the seals present, or where a 'disturbed' seal comes into conflict with other seals as a result of reacting to the human stimulus.

5.66 Regarding responses to human activity, behaviour falls into a minimum of 4 categories. There may be no response, because the seal is asleep, deeply relaxed or untroubled (that is, to some degree habituated). It may watch from a resting position or it may come to the alert and stare intently at the source of the stimulus. It may begin to move, changing position rather than entering the sea. Lastly, it may stampede or dive into the sea.

5.67 In such responses, it is important to have recognised when each seal hauled out (where numbers are relatively low), as this is a complicating detail. When first hauled out from the sea and until their pelages have dried, seals appear to be relatively restless. Subsequently, they appear to become more settled (Chilvers et al, 1999).

5.68 If there is the need for an alternative design to glean a more detailed insight into the behaviour of individual seals, it is recommended that focus be upon the vigilance of individual seals. Here, the monitoring would compare the time spent by the seal at rest (with its head on the substrate) with that when the seal was alert (with its head raised). Recommended is 15 minutes with one seal followed by 15 minutes with another, randomly selected. Such a study would also need to take into account the time when each seal hauled out.

5.69 It is imperative that the amount of human activity is quantified: how many people are walking by, stopping near or walking on the seal site? How many boats are passing within about 100 metres of the site? Does the wash from boats passing at a distance greater than 100 metres from the site wash seals from the rocks they are using?

Table 1 Seals ashore

Seal behaviour
Asleep or relaxed at rest
Alert/vigilant
Moving
Hurrying into sea
Seal-seal interaction

OR:

Table 1a Seals ashore: vigilance v non-vigilance

Seal behaviour
At rest
Vigilant

Table 2 Seal-seal interactions ashore

Seal behaviour
Yielding ground
Capturing ground
'Stand-off' where neither gains nor loses position
Threatening behaviour: open mouthed threat
Lunging
Flippering

Table 3 Seals in the sea

Seal behaviour
Bottling
Craning neck to watch something
Logging
Under surface swimming
Swimming at surface
Diving (without haste)
Splash/Crash dive
Feeding
Prospecting around rock with a view to hauling out
Hauling out
Friendly meeting with another seal
‘Play’ between 2 seals
Aggression between 2 seals
Chase between seals
Watching source of disturbance
Approaching source of disturbance
Fleeing source of disturbance under surface

Table 4 Boat Behaviour (continuous count)

How many craft are within 100m. of seals?

Table 5 Type of boat (continuous count)

Type of boat
Commercial fishing boat
Angler
Pleasure boat (Name, if possible; if not, make simple drawing & note colour)
Sailing craft
Motor vessel
Naval vessel
Jet ski
Canoe
Dive Boat
Other

Table 6 Boat Activity (continuous count)

Boat activity
Passing between shore & archipelago
Passing outside archipelago
Moving north
Moving south
Not moving: at anchor
People clearly observing seals
Approximate distance from nearest seal
In seal lagoon

Table 7 Human behaviour at Peartree Point

Human behaviour
People walking on coastal footpath not looking toward seals
People walking on coastal footpath noticing seals but not leaving FP
People watching seals from grass sward above beach
People on beach: watching seals
People on beach: not watching seals
People on rocks: not watching seals
People on rocks: trying to get close to seals
People with dog(s)

Table 8 No. of people within 50m.of seals at Peartree Point

Human behaviour
Inflatable boat
Sailing craft
Canoe
Jet ski
Dive-boat
On the rocks
Other

Ameliorating the potential for future disturbance

5.70 Analysis of the survey sheets, supported by film/photographs showing sequences of disturbance will reveal:

- The extent to which the seals disturb one another, when and how.
- The extent and frequency of occurrence of unwitting human disturbance events, with descriptions.
- The extent and frequency of occurrence of disturbance events after otherwise sensitive approaches and extended periods of observation by people in boats.
- The extent to which gross disturbance occurs and how.

5.71 By the end of any period of fieldwork, a set of management recommendations should have suggested themselves. These should accompany the results to the appropriate managing/monitoring authority. When the work has been completed, it will yield information about various aspects of disturbance.

5.72 Supplementary to the management recommendations, it is helpful - particularly to those being affected by the recommendations - to draw up a grey seal fact file. It should briefly outline the

status of the grey seal in the world, national and local contexts, key details of their life cycle, relevant behavioural information as well as the extent to which the grey seal is protected under various laws. These should be designed to allow easy reference by people seeking background information about seals.

5.73 The deliberate disturbance of seals (for example, accidentally during the course of research) should be prohibited by byelaw and should require a permit.

5.74 Permits should also be required by people such as TV crews who wish to approach close to seals, even though they do not intend to cause disturbance.

Managing seal sites subject to disturbance

5.75 The next phase is to draw together parties associated with and concerned about the disturbance, debate any contentious issues arising and agree a management plan to reduce or eradicate seal disturbance. The plan can then be implemented.

5.76 The venue for any such discussion should be in the harbour master's office or in the offices of the local navigation authority.

5.77 The central element of the management plan will be the question of how close to the seal site boats may approach. Everyone should be quite clear that there is no single definition because seal susceptibility to disturbance caused by the approach of a boat varies:

- From site to site.
- According to how the boat is handled, perhaps even according to the size of the boat.
- Varies according to whether a disturbance event has already taken place on the current cycle of the tide.

5.78 If people were sufficiently well informed and trustworthy, which in some cases they are not, the ideal regulator of the approach distance would be the seal itself. The 'tripwire moment' after which disturbance is very likely to ensue is when the seal lifts its head and stares intently at the approaching vessel. At such times, it may alter position and, on the brink of choosing to enter the sea, one fore flipper may be raised. Where that scenario occurs, disturbance is almost certain. The tripwire moment was where the seal raised its head and stared intently at the approaching vessel. That was the point at which the vessel should not only have ceased to approach but should have begun to very slowly move farther away from the site.

5.79 However, there are sites where seals have become habituated to a relatively close approach by boats carrying passengers, as at Menawethan in the Eastern Isles of the Isles of Scilly. In such instances, that should be borne in mind when devising local codes of conduct. Nevertheless, there has to remain a buffer of distance separating people from the largest wild animal currently breeding ashore in the British Isles, at all sites.

5.80 That (absolute minimum) buffer should be 15 metres for all sites. However, if the tripwire moment described above occurs at a distance greater than 15m, this should be the distance at which the vessel not only ceases to approach but should begin to slowly move farther away from the site.

5.81 It is also considered unwise as well as improper to throw dead fish to seals, as has been described as happening at the Carracks, four miles west of St. Ives. This practice may have the potential to influence seals towards eating dead fish, thereby intensifying their conflict with those fishermen who believe seals are removing fish from their nets. It also makes something of a circus event out of an encounter with a wild animal in a wild place.

5.82 Finally, after a 5-year period, a review of the way the recommendations are working should be carried out. The management plan can then be refined where necessary.

Photographic examples of disturbance events

(taken from the Study of the Disturbance of Grey Seals in south Devonshire - Westcott 2006)

Plate 1 Example of disturbance by boat

In this image, the boat has approached so close to the seal on the (slightly submerged) rock that although now at a standstill, the proximity, along with the highly visible people on board, has caused the seal to crash into the sea and escape swiftly underwater. The seal is visible under the surface immediately to the left of the white water swirl, making its getaway.

Plate 2 Example of disturbance by kayakers

Kayakers landed on the Reef, on one side of the lagoon and remained there for two hours. Exceptionally, no seals hauled out on that tide despite otherwise ideal hauling out conditions.

Plate 3 Example of disturbance by anchored boat and kayakers

A boat, accompanying the kayakers, anchored in the lagoon: a further deterrent to any thought of hauling out on the part of the seals.

Plate 4 Example of disturbance by divers

A dive boat in the shadow of the Mew Stone. The presence of divers in the sea during this survey deterred seals from hauling out.

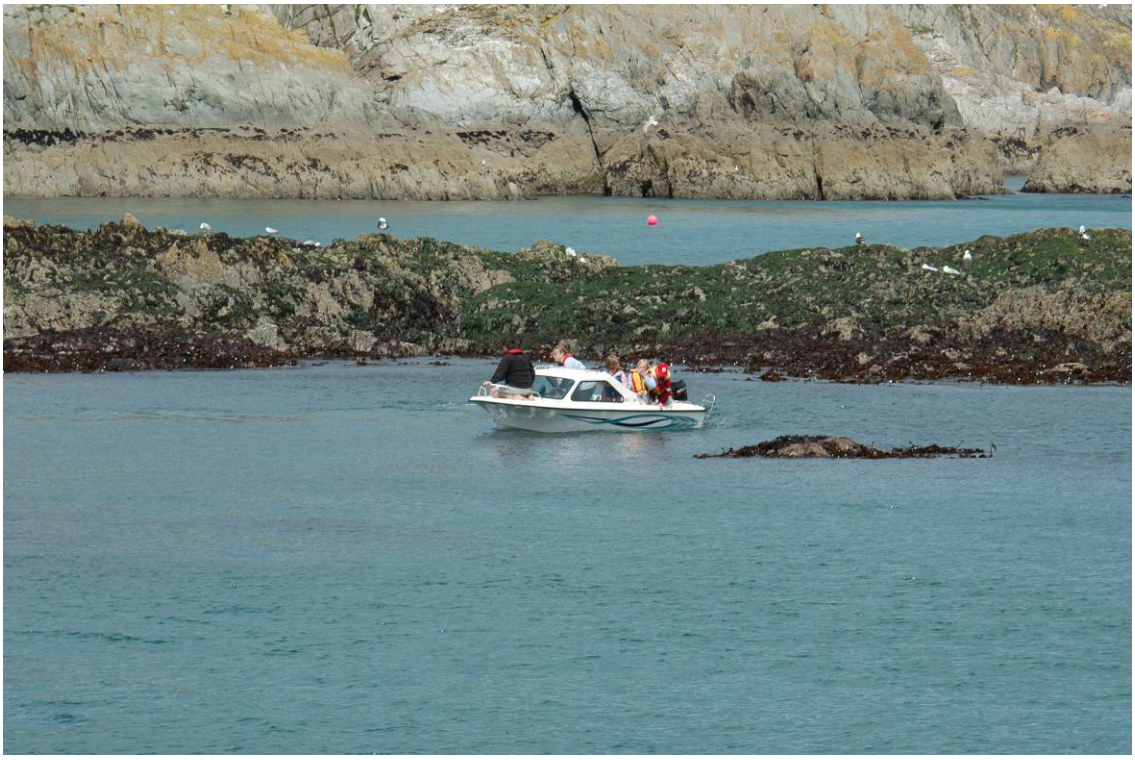

Plate 5 Example of disturbance by boat in voluntary exclusion zone

Boat in the lagoon voluntary exclusion zone between Seal Rock (foreground) and the Reef. The man in the bows is watching the rings of water left by the seal that had just crash-dived.

Plate 6 Example of disturbance by boat

Boat approaches seal on Flat Skerries, turns broadside on, making more people visible to the seal. The seal enters the sea.

Plate 7 Example of disturbance by commercial boat in voluntary exclusion zone

The only commercial boat to ignore the lagoon voluntary exclusion zone, here seen inside the Reef approaching the lone female seal resting on Seal Rock.

6 Procedural guidelines: tracking grey seal movements by photo-identification

6.1 All on-site work must be carried out by a specialist unit, having obtained all relevant licences from Natural England, and been trained to cause least possible disturbance while collecting the data in the quickest possible time.

Introduction

6.2 It is possible to use photo-identification because grey seal pelage patterns remain constant over time, with every animal bearing a different pattern of markings. However, each seal has a different pattern on left and right profiles. (Hiby & Lovell, 1990).

6.3 Although it is the entire body pattern that is unique to each individual grey seal, in photo-identification only the head and neck (and sometimes the chest) pattern is captured on film (Hiby & Lovell, 1990). This is because only that part of the body is showing when the seal is swimming. Grey seals spend at least 80% of their lives in the sea.

6.4 Following an initial scan of images to remove those of poor quality, the good quality photographs are digitised. Ideally, this procedure will be followed by a computer-aided comparison of images using software developed by Hiby & Lovell capable of identifying matches, regardless of the position of the head of the seal and the extent to which that appears to stretch and 'distort' the pattern.

6.5 The purpose of photo-identification is to achieve a better understanding of the life history of seals, including their fidelity to terrestrial and foraging sites, to the seasons of the year and to one another, their fecundity and their responses - both as individuals and in assemblies - to disturbance.

6.6 The positive aspects of photo-identification are that the methods are simple, inexpensive, non-invasive and good for examining fine-scale population structure. It offers considerable scope for volunteer effort to make a substantial contribution to the catalogues.

6.7 The most obvious negative aspect to photo-identification effort is that it is labour intensive, as it must cover the entire range of the stock.

6.8 In current and future work, rather than capturing images primarily of well-marked (usually adult female) seals, seal mothers, attendant bulls and moulted pups should be photographed in effort that is locally-based and draws heavily on volunteer contribution in order to learn more about the relationships between seals using specific sites for the various reasons.

6.9 In this way, a compilation of life histories for individual seals using the main sites in southwest England has been initiated and will add value to the existing photo-identification catalogues for this and neighbouring sea areas (photo-catalogues exist for the grey seals of Brittany, Southwest Wales & Eire, North Wales, Isle of Man and Cumbria. SMRU holds catalogues of images captured at Donna Nook (Lincolnshire), North Rona and the Isle of May.

6.10 The most substantial photo-catalogue in existence for the southwest and neighbouring regions is the EIRPHOT catalogue, containing images collected since 1996 for seals along the coasts of

southwest England, southwest Wales, south Eire and Brittany. It was initiated in 1996 under the auspices of a Wales (CCW)/Ireland (University of Cork) INTERREG collaboration (Kiely et al, 2000).

6.11 Indeed, photo-identification catalogues become more useful the more they are used because the likelihood of recaptures increases (Hiby, pers.comms.).

6.12 Separate local catalogues, identifying seals involved in local pup production (seal mothers, moulted pups and attendant bulls), have been started for the Isles of Scilly and North Wales. The images are also integrated into the general catalogues for those places.

Protocol

- Write down the time that the photographic session begins and ends.
- Count the number of seals present at the beginning and end of the photographic session, noting sex and age and categorising the patterns as good, middling or poor (that is, vivid, middling or mainly dark).
- Set up a camcorder on a tripod, focussed on the breadth of assembled seals. Set the camera running just prior to beginning the capture of still images. Stop the camcorder when the capture of still images ceases.
- This enables accurate matching of left and right profiles of individual seals in the laboratory, prior to scanning into the database.
- Capture photo-ID (head-and-neck) record of individual seals, preferably while on land, in order to capture the maximum area of neck patterning.
- The best time to capture such images is when the seal is within 30 minutes of having emerged from the sea that is on a falling tide. The seal tends to be restless while moving toward a favoured resting place. It will tend to look about it, offering opportunities to capture both left and right profiles. At the same time, seals ‘prospecting’ with a view to hauling out of the sea often crane their necks telescopically before actually emerging. This offers another particularly good opportunity for the capture of maximum extents of pelage patterns.
- Images captured of seals with dry pelages may be acceptable but tend to be less than ideal.
- If the seals return to the sea, a second person should immediately draw their attention in such a way that they offer broadside-on profiles to the (concealed) photographer. This can be achieved by making elaborate movements, by singing or by whistling. This person should be equipped with a camera to capture opportunistic images. Images should be captured as quickly as possible at this time because seals will soon depart the immediate vicinity.
- At all times, the sequence in which the photographs are taken may be dictated into a Dictaphone, with particular effort to note where and when (during the current session) the other profile of the same seal was captured.
- Take especial care to capture images of seals entangled in netting and seals with injuries or distinctive scars. This allows for the immediate identification of a small sample of seals by eye, without reference to photographic record.
- All support gear - including extra films, flash unit and at least two back-up sets of batteries for each item of equipment so powered - is most comfortably carried in a rucksack or Lowepro dry case.
- It might be wise to carry a stick on site, both to help maintain balance on a surface that is often slippery and for use in making rough measurements (of the site or of the corpses of marine mammals discovered stranded there). It can be divided into specific lengths by the use of electrician’s tape.
- Ideally, the photographer should remain totally invisible to the seals at all times. This is a matter of good field craft. This will stem from feeling at home on the slippery rocks and always remembering what lies behind. It is imperative to ensure that a recognisably human profile is never offered to the seals, whilst also remembering that the seals’ view is likely to be angled

steeply upwards: the fieldworker will nearly always be level with or overlooking the assembled seals.

- In certain situations, where there is scant opportunity for concealment, it may be helpful to distort the shape of your head and conceal the brightness of your face. Adapt a wet suit, reinforcing the knees and elbows, padding the torso. No matter how ridiculous you may think you look, construct appropriate headwear: sew fronds of seaweed on to a hat - back as well as front, because there will be times when seals lie behind as well as in front of you in a rocky environment.
- The foremost complicating detail when attempting to approach seals hauled out on rocky shores is that very often they are not gathered in one locality alone. There may be several groups at points around the site, as well as the occasional solitary seal resting alone. This can render unobserved approach impossible. At such times, the fieldworker has to make a choice:

a) Disturb a lone seal in order to reach a desired point of proximity to a larger group of seals.
b) Disturb a small group of seals in order to reach a desired point of proximity to a larger group of seals.
c) Abandon the site in order to avoid causing disturbance.

- While making every effort to avoid it, accept that disturbance may result from any expedition and be prepared to take advantage of it as it begins to happen.

Tracking individual tagged seals

6.13 Grey seals are difficult to study because the great majority of their lives are spent in the sea. Even when ashore, because of their habit of assembling in large numbers resting close together, it is extremely difficult to keep track of identified individuals. It is even more difficult to make studies of seals ashore in sea caves.

6.14 Various forms of tagging have employed since the first grey seal was tagged (on the Farne Islands) in 1951. There was a prolonged tagging programme operated at southwest Wales nursery sites in which tags were attached to the hind flippers of pups. Subsequently, recaptures were reported from as far afield as southwest England, Brittany and as far west as the west coast of Eire. The northernmost recovery was made from Ynys Môn/Anglesey.

6.15 Tags used were adapted version of those used for tagging cattle. Initially, aluminium tags, then stainless steel tags were used, until 1961, when brightly coloured plastic rototags came into use. Attachment was best achieved by stretching the inter-digital web of one of the hind flippers until it was taut. The tag was attached as close as possible to the proximal web before being ‘locked’ by pliers. This was to ensure that the tag could not revolve around the peg used to connect the two components of the tag, thereby wearing a hole in the webbing. The tag had to face upwards to avoid abrasion when the seal was ashore (Summers and Witthames,).

6.16 Tagging schemes were heavily reliant on the public reporting sightings.

6.17 A weakness of the system was that only a small proportion of tagged animals were recaptured. However, they served to inform the view of Hewer (1974) that pups disperse radially from nursery sites, with dispersal being brought about principally by wind action on surface water. In addition, he found that there was considerable overlap of movements of seals from different places.

6.18 Because one element of tag recoveries was from dead seals taken as bycatch in fishing nets, information about the birthplace of those seals interacting with certain fisheries was established.

6.19 Tags yield incidental information about individual seals.

6.20 Tags were and remain cheap and easy to apply.

6.21 However, the negative aspects of the tags are their small size and the fact that (usually) they can be seen only when the seal is on land. Even where the tag is seen (and is not concealed by the way in which the seal is lying or by the bodies of other seals), the unique legend it bears is extremely difficult to read from distance, even when binoculars are used.

6.22 Hat tagging is a method that has been deployed in southwest England by the seal sanctuary at Gweek. Since 2003, all seals released from terms in the unit have been hat tagged, in order to gather information about their fate.

6.23 In addition, sightings of hat-tagged seals released from Brittany during the 1990s were recorded by observers in west Cornwall, the Isles of Scilly and south Devon (Vincent, 2001), but also by observers in Eire and southwest Wales.

6.24 As with photo-identification, this method is labour intensive in that it requires the input of the public, to report where tagged seals are located. However, this can only be interpreted as a partial-negative because public involvement also means the public are informed and engaged in conservation work and what is also a modest scientific frontier.

6.25 A strong volunteer coastal observer network in southwest England - Seaquest Southwest - has been in existence since 1999. It exists to monitor the movements of marine animals and to report live and dead strandings. Based primarily at the wildlife trusts, its existence greatly improves confidence that good quality sightings will be made.

6.26 However, there are two peerless means of collecting exquisitely detailed information about seal movements and which also yield detail about the favourite foraging areas of the seals - something particularly relevant in a region containing the foremost fishing port in England (Newlyn) as well as other regionally and locally important fishing harbours.

6.27 Both require the capture of seals and the attachment of remote tracking devices by the Sea Mammal Research Unit.

6.28 Satellite tracking using Argos Satellite Relay Data Loggers (SRDLs) provides very detailed data concerning seal movements, diving and foraging behaviour. However, it is important to note that equipment is both relatively expensive, which means that only a small sample of seals can be tagged, and is not guaranteed against malfunction. Thereafter, the processing of the data is also expensive.

6.29 Nevertheless, it is the best method for tracking seal movements between haul-out sites. It allowed McConnell et al (1999) to provide a number of insights into seal behaviour, incidentally helpful to designing photo-identification effort. They included the fact that seal movements were on two geographical scales: long and distant travel (up to 2100 kilometres away) usually to known haul-out sites, covering between 75-100 kilometres per day with local, repeat trips to discrete offshore areas. In 88% of trips to sea by individual seals, they returned to the haul-out site from which they departed, with trips lasting a mean of 2.33 days and having foraged in often localised areas characterised by gravel/sand seabed sediment. Dives in these areas tended to be to the seabed. The extent of return trips from a haul-out site showed a mean of 39.8 kilometres, but 43% of all the seals' time was spent within 10 kilometres of the haul-out site.

6.30 However, none of the satellite-tagged seals ventured into the Irish Sea, Celtic Sea or Western Approaches. The only (4) satellite-tagged seals to enter these sea areas were tagged by SMRU in Brittany (Vincent, 2001). The seals tracked were all juvenile, rehabilitated individuals. Of these, one travelled via west Cornwall to the Saltee Islands and up the coast of the Irish Republic to Dublin Bay.

6.31 More recently, work associated with the SEA 6 included tagging 19 grey seals in Wales. Results appear to identify foraging areas at sea as well as travel patterns and haul-out locations.

6.32 A comparatively new option, initiated in 2001 and currently in the second phase of field-testing, is the use of the texting facility of mobile phones glued to the heads of seals. Currently one-tenth

the price of the SRDLs, this means a larger sample of seals can be studied. This method can also be used in conjunction with a photo-identification effort because each phone carries a unique legend. When photographed, with date and site being recorded, the photo-ID data can be compared against results (or absence of results) being generated by the mobile phone.

6.33 Based on GSM mobile phone technology, each seals receives a mobile phone tag that is glued just behind the crown of the head, programmed to send a text message back to the laboratory at regular intervals. This is possible so long as they are within range of one of the thousands of GSM cell stations around the coasts of Europe that are continuously listening for test messages. This (variable) coverage extends to 20 kilometres offshore.

6.34 In the second phase of testing, high band-width data connection have been introduced that will result in remotely downloadable time-depth recordings as well as downlinking of instructions to the phone tag. A hybrid-GPS sensor is also being developed to be incorporated in the tag to assist the investigation of fine scale ecology of marine mammals.

6.35 The life of this kind of tag, as with SRDLs and plastic hat tags is up to one year - theoretically, until the annual moult occurs and the tag is shed.

6.36 Although the expense of the SRDLs is likely to be prohibitive in initiatives proposed via Natural England in the region, the mobile phone tags seem likely to be the best means of studying seals-fisheries inter-actions. They would also offer a perfect tool for examining the fate of seals released from the seal sanctuary.

Methods

Disturbance

6.37 In all work with seals, the principal objective of the fieldworker has to be to remain unnoticed by the seals: cultivate the art of the invisible.

6.38 Causing disturbance through the effort to capture photo-identification images should be avoided not least because the work will always be undertaken, at least in part, to support conservation objectives. Furthermore, the practise of good fieldcraft should mean that it is totally unnecessary to cause disturbance.

6.39 It would appear to be extremely unwise to take pictures at any site either on consecutive days (where disturbance has occurred) or more than twice a week. Although not quantified during surveys to date, impressions indicate that haul-out numbers dip on the day following a disturbance event. This can be verified by use of (site specific) low water counts.

6.40 Best quality fieldcraft is most essential when photo-ID takes place at nursery sites where, in any case, the capture of images will be secondary to the effort to locate and count all pups. Here, the standard practise must always be to spend least possible time on site causing least possible disturbance.

6.41 However, upon occasion the primary objective is to collect images as part of the design process for developing a new and essential tool for understanding aspects of seal biology (for example, developing a photographic key that allows accurate aging of unweaned pups based on the development of physical features). Here, although good fieldcraft should be employed as rigorously as before, disturbance is almost certain to occur. While regrettable, such disturbance is justifiable.

6.42 In such circumstances, there is always the fear that disturbance will lead to the severing of the essential mother-pup bond. This must be the paramount consideration. However, while disturbance should be avoided, seal mothers are not casually separated from their pups and, in

all studies carried out to date by the author, there has not been a single case of abandonment by a mother of her pup.

6.43 The justification for continuing to collect data even where some disturbance is caused (for example as in the abovementioned case, where a key for aging pups based on accurate perception of developing features in a pup) is that it will lead to the development of a tool that should ensure fieldworkers spend less time on site in the future. Less time on site should also mean less time potentially causing disturbance to seals.

6.44 The challenge to minimise disturbance is (usually) most acute in sea caves, where general working conditions are most difficult and where any seal there present would already be 'disturbed' by, or at least aware of, the presence of a fieldworker.

6.45 On beaches and islands, the options to use hides and/or remote viewpoints exist as potent means of avoiding causing disturbance.

Use of a camcorder

6.46 Good quality camcorders can be the ideal tool for capturing images of seals close up and at distance, and are also the essential piece of equipment where photo-identification effort is focussed on a large assembly of seals.

6.47 The choice here is personal preference. Camcorders are being progressively improved. To date, a Canon XL1S digital camcorder with a standard lens has used and found to be excellent for the tasks. Among its several qualities, crucially at full zoom there is no distortion of the image. It yields excellent results when used in the dark, damp conditions of the sea caves, with Kowalski 1250 torches providing illumination. It yields excellent results when deployed under the open sky.

6.48 Cost considerations meant that the 400mm. zoom lens, used by professional wildlife film-makers, was not considered for use although it could have been the ideal lens to capture the quality of images required (this was not tested).

6.49 The camcorder should always be used in combination with a tripod, except where environmental conditions are the prime consideration. Examples are where high winds are blowing or inside (some) sea caves. However, it should be noted that tripods could be awkward to carry over the kind of terrain likely to be encountered in seal fieldwork, even when carried in a shoulder bag.

6.50 The only negative feature of this camcorder is the cost of making the single mistake that leaves it requiring repair. During this survey, another camcorder was being used to film a seal departing a cave. The fieldworker made no movement at all, in order to avoid adding to the anxiety of the seal, which tried first to leave by way of the far side of the cave. That way being blocked, she passed close by the fieldworker while using the only other route available. When close by, she powerfully thrashed her tail flippers in order to hasten her passage through the shallow water. The camcorder was lifted above the head of the fieldworker almost simultaneously, but a few droplets still hit it. These were wiped away immediately. It seemed innocuous, certainly not enough to cause a malfunction; but it proved fatal to the camcorder.

6.51 Great effort must be made to keep the camcorder dry and to protect it against being bumped.

6.52 It can be used in two capacities:

- It can be used to capture photo-images as the primary tool.
- Alternatively, it can be activated at the beginning of a session where the primary means of capturing images is a camera and especially where a group of seals is assembled. In this situation, it becomes difficult to keep track of the movements of the seals around the site and, particularly, to be certain which image captured of the left profile of a seal belongs with which right profile image for the same seal. Different means have been tried, specifically describing the image-captured to a voice-activated Dictaphone and making written notes.

6.53 Referring to the camcorder record is the most accurate way to resolve the uncertainty.

Use of a single lens reflex (SLR) camera

6.54 The prime reason for continuing to use SLR cameras is the high image quality, which continues to compare favourably with digital images at present.

6.55 Most photographs or transparencies of seals are likely to be captured at distance, except inside sea caves.

6.56 Hiby (1997) pioneered this method, using a 35mm. format camera with 840mm. autofocus mirror lens.

6.57 In local survey work to date, cost considerations determined that two second-hand 35mm format camera bodies be used (Nikon F301 and Nikon 501 - a spare camera always being carried). Two lenses were used: a Sigma 70-300mm. lens and a Sigma 600mm. lens, both of which were manual focus - a personal preference. However, better quality lenses would have yielded better quality images.

6.58 In sea caves, a flash unit must be used. In local surveys to date, a Nikon Speedlight SB-20 was used.

6.59 For photographs, Ilford XP2 (400 ASA, black and white) film was used, being developed using the colour processing option.

6.60 For transparencies, either Fujichrome or Kodakchrome were used, at 100 or 200 ASA.

6.61 It is necessary to use either a tripod or a beanbag to support the camera when the 600mm. lens is being used. Although optional, where a 300mm. lens is used, a tripod is recommended.

6.62 A description of the sequence of shots being taken can be spoken into a voice-activated Dictaphone attached to a lapel, as this leaves the hands free and ensures no interruption in the fluency of the photographic effort. Detail recorded should follow an initial introduction naming the site, the date and the time photography began. When photography commences, information recorded should follow, in sequence:

- Location.
- Date.
- Total number of seals present on site.
- Sex of animal.
- Whether it is a mother or an attendant male.
- Whether it is the left, right or head-on profile.
- Whether it is on land or in the sea.
- Whether it has any distinguishing features - such as being blind in one eye.
- Name of the photographer.

6.63 It is also valuable to conclude by noting if it has definitely or possibly been photographed during the current session. If it has not previously been photographed, no mention need be made of this. This is helpful when it comes to entering the images on to the database, in identifying which pairs or trios of images are of the same seal.

6.64 However, this method is likely to prove flawed when it comes to reviewing the images and making the initial matches by eye. Strongly preferred, wherever possible, is that a camcorder set on a tripod be set running just before the photographic effort begins and stops after the capture of the final image. This allows the pairs of profiles to be checked before data entry proceeds.

6.65 It might be wise to carry a stick on site, both to help maintain balance on a surface that is often slippery and for use in making rough measurements (of the site or of the corpses of marine mammals discovered stranded there). It can be divided into specific lengths by the use of electrician's tape.

Use of a compact digital camera

6.66 To the present, a Nikon Coolpix 4500 and Coolpix 5400 digital cameras have been used in combination with the other cameras. They are excellent for close range work - as close as one metre. In sea caves, they are the camera of choice on account of their small size and ease of use. At these times, a divers lamp must be used to provide illumination (Kowalski 620 or 1250 are recommended), although there is also a built in flash. Both cameras have a zoom lens.

6.67 There are three great virtues to this type of camera. The first is that on-site editing can be carried out simply. There is no delay, waiting for the film to be processed before it can be seen whether the image captured was adequate or not. If not, then there is often the potential to try again and this time get it right.

6.68 The second is that on the day the image has been captured, it can be processed into the database - this being the ideal form of data entry, rather than waiting for film to be processed and returned.

6.69 The third is that large numbers of images can be captured and stored on one memory card, comparing very favourably with the 36 images on a roll of film, and there is the option of carrying extra memory cards - which are also much less bulky than the film used in standard SLR cameras.

6.70 Beware condensation and other sources of dampness.

6.71 The results achieved are excellent. To date, it has been found to be excellent when used at close quarters to seals in sea caves where ambient light levels can be extremely low. It has also been found to be excellent for close quarters image capture, for example noting the details of pup development on nursery sites.

6.72 Otherwise, its primary value is in functioning as a 'visual' notebook - supplementing other records when writing up the record of the events of the day.

6.73 There is one crucial negative feature. There is a delay between pressing the shutter release and the image capture. This brief interlude allows the subject to move and often results in the loss of the target image.

6.74 In this survey, the Nikon Coolpix 4500 was found to be a more useful tool than the 5400; therefore, only the former is recommended.

Use of a digital single lens reflex camera

6.75 In recent survey work, a Canon EOS 20D camera body was used with a 70-300mm. Nikkor lens. It became the camera of choice for the capture of identification images.

6.76 Subsequent to the survey, a Nikon D70 was used. Although there is little difference between the two, the Canon was preferred because the image to be captured appeared on the monitor before capture. With the Nikon, it appeared only after capture.

6.77 A Danubia T2 Adaptor was used to allow the camera body to be connected to a Leica Televid 77 telescope, subsequent to survey work on the island. This gave the camera, in effect, a high quality 1200mm. lens. It is described here because it was found to enhance what had already proved to be a superb tool by allowing the capture of images from greater range - something that allows us to be better able to avoid causing disturbance to the seals.

6.78 In general, while being more robust than the digital cameras used, it shares the advantages ascribed to them while yielding, in addition, top quality images.

Recommended photographic equipment

6.79 To date, the Canon XL1s camcorder and the Canon EOS 20D with 70-300mm. lens have proved to be the finest tools tested.

6.80 In general, transparency images captured using the SLR camera are of good quality, especially when compared with images captured by the Nikon Coolpix 4500 - regarded as the better of the two digital cameras tested - but the long wait to have the film processed and the time element in digitising the image is regarded as a strong negative insofar as it is impossible to make daily data entry. Against this, it must be remembered that image quality is good and data entry simply requires that painstakingly accurate records be kept and stored of where, when and of which seal the images were captured. Against this, it can be said that the storage and belated entry of data for specific images introduces extra possibilities for human error to become manifest.

6.81 The digital camera was used to best effect at close quarters. Otherwise, image quality was variable.

6.82 In previous photo-ID surveys, single lens reflex cameras with a minimum 300mm. lens have been used in combination with the Ilford XP2 black and white film (but developed using colour processing) recommended by Hiby (pers.comms.). Overall, however, digital photography and filming allow immediate review and filing of images, and this is regarded as a massively positive feature. Furthermore, the trend toward ever-finer digital imagery can only enhance this preference. However, this is in contrast with equipment choice for other recent surveys (Kiely et al, 2000; Vincent et al, 2001).

6.83 The items of equipment tested during this survey all generated only a small proportion of adequate results. This was due, in part, to the way in which the operators used them but to an extent also on environmental conditions and the constant movement of the sea around the heads of swimming seals.

The image target area

6.84 In all photo-ID work, it is important that the contrast in the patterning of the target pelage area be categorised as good, moderate or poor.

6.85 Where photo-ID takes place in conjunction with abundance and distribution counts, the initial task will be to count, age and identify the sex of seals there present. It is important to know what proportion of the seals counted at a site is included in the photographic record of every day.

6.86 It should also be remembered at all times there are other features that, along with the pelage pattern, identify individual seals. These include, for example, nose shape; the grey ‘base’ pattern - sometimes total, sometimes stippled; distinguishing marks on the nose in particular or the crown; a small minority wear shawls or bands of derelict fishing gear.

6.87 The ideal is to approach sufficiently close to any seal being photographed that a ‘head and shoulder’ shot would fill the viewfinder.

6.88 The objective in photo-identification work is to capture images of the largest percentage of seals hauled out on, or in the sea adjacent to, any site. Ideally, for every seal a full set of left, right and head-on images will be captured.

6.89 The best time to take photographs is likely to be around low tide, when the assembly can be expected to be at its maximum size. However, care must be taken to avoid causing disturbance at this time.

6.90 The ideal image will show a broadside-on view of the maximum extent of the profile.

6.91 It is preferable to capture images of seals whose pelages are wet because the pattern is much more clearly defined. The pelage stays wet for at least 30 minutes after the seal has hauled out, from the time of hauling out. At this time, the seal is likely to spend some time getting settled. This is when the observer has the best chance of seeing both left and right profiles of the animal.

6.92 Where the pelage is dry, the pattern is usually still clearly discernible but the edges are fuzzy, making comparisons more difficult to effect successfully.

6.93 In standard photo-identification work, the principal objective has been to capture images of 'well-marked' seals (usually adult females). This describes pelages with distinctive black and white patterns. Furthermore, usually only one profile of any seal was captured unless, once seals had entered the sea, a second fieldworker captured their attention, first to the left, then to the right, of the photographer. In theory, this allowed the capture of both profiles.

6.94 It is important to know that the left and right patterns are always dissimilar: that is why we are seeking to capture both of them.

6.95 It is always helpful if the profile image includes as much as possible of the central part of the nose that runs from eyes to snout (see 'scanning images', below).

6.96 It is preferable to capture images of seals on land rather than in the sea. This is because seals on land display a greater area of pelage. In the sea, the extent of pelage pattern showing varies either because it is a habit of grey seals to carry their heads quite low in the water while swimming, thereby concealing the greater part of the target pelage area, or because of wave action, in constant motion up and down the neck (target) area. Consequently, the principal cause of the capture of inadequate images of seals in the sea will be wave action.

6.97 In the earliest photographic identification studies, haul-out sites (all on the east coasts of Britain) were approached from the sea, using inflatable boats that were run ashore. The seals were startled into the sea but not to the point that they abandoned the vicinity. They would linger, close to the shore, watching the fieldworkers (Hiby, 1997).

6.98 Although they would begin to disperse, typically one fieldworker took captured photographic images while the other put on a performance designed to attract the attention of the seals - first to one side of the photographer, allowing the capture of one profile, then to the other side so that the other profile of the seals could be captured (Hiby, 1997).

6.99 The greatest advantage of this method was that the pelages of the seals were wet, thereby offering the 'cleanest' pattern to be photographed.

6.100 The greatest negative feature of the method was the disturbance caused to the seals, driven into the sea before they would have chosen so to do.

6.101 However, at sites such as Donna Nook in Lincolnshire, relatively close approach can be made across the sands to seals, sufficient to capture good quality images without driving them into the sea.

6.102 Therefore, in the context of research designed to maintain seals at favourable conservation status, as is the foreseeable context for seal research in the region, and because seals rarely use sand flat sites in southwest England (except deep inside sea caves), an alternative method must be used. This is where good and well-practised fieldcraft and the use of hides come into their own. The exception is where visits to sea caves are made (see Procedural Guidelines: Applicable to all fieldwork).

6.103 On island sites, there are opportunities to photograph seals without disturbing them (see below) and without them becoming aware of the photographer - either by using the features of the terrain to remain 'invisible' or by use of a hide. However, where the seals sense the presence of a

fieldworker, that very process of becoming aware - the craning of necks, the turning of heads - does offer a brief window of photographic opportunities before the assembled seals either settle or become more restless.

6.104 Being aware that the seals might stampede into the sea and where they are likely to enter the sea, the photographer should try to be positioned so as to avoid shooting into sunlight and, subsequently, sun-silvered sea.

6.105 Once in the sea, another window of photographic opportunity opens. Upon first entering the sea, the seals tend to dive. However, when surfacing for the first time, it is not uncommon for them to 'stand' very tall in the water, showing a maximum display of chest or sideways-on profiles as they look around, trying to gather about what is going on around them. As many photographs as possible should be made at this time. Indeed, at this point, although ideally the camera will be finely focussed, the fact that it may not be should not inhibit the capture of as many images as possible - the window of opportunity being so narrow.

6.106 Commonly, having entered the sea, seals may mill near the point where they entered the sea, searching for or gazing at the source of the disturbance. They may remain milling at this point for between 5 and 15 minutes, after which there is likely to be an exodus of seals from the locality. Therefore, in this period, as many photographs as possible should be taken.

6.107 However, where seals are in the sea, when photographing wet seals in sunlight the pelage pattern can be 'irradiated' by sunlight.

6.108 In this period, it is more than ever important for the camcorder to be used as back up. Seals will spend their time submerging and emerging, confusing any other effort to match images of left and right profiles. If these 'both-profile' shots are not identified, it could take years to discover that two profiles belong to the one individual. This makes it significantly more difficult to learn about seal movements between sites and across time.

6.109 The camcorder is not a sideshow. It is an essential component of all fieldwork.

6.110 The greatest likelihood of re-capturing seal images is when the seal is 'well-marked' with a clear black and white or black and cream pattern. Nearly all such individuals are female. However, when attempting to capture images in the vicinity of nursery sites, very few males are present. It seems as if nursery sites are emptied of all but 'essential' seals.

6.111 In effect, males there present are very likely to be the first to mate with the local females when they come into oestrus near the end of the (usually) 15 to 19 day period of lactation. In effect, almost more than deterring other males from the vicinity, they are present to ingratiate themselves to the seal mothers are thereby win the chance to mate first with them when they come into oestrus. Therefore, although males are rarely 'well-marked', photographs should be taken in the hope that not only the pattern but also the highly variable shape of the nose (the Latin name for the grey seal, *Halichoerus grypus*, translates as 'hook-nosed sea pig') might allow subsequent identification of the individual males along with any hint of site fidelity either in the nursery period or the year round. It is also interesting to discover whether individual males conduct abiding relationships with female seals locally.

6.112 Often, more than one portrait of an individual seal will be captured during a recording session, sometimes by chance but often in the hope of getting a clearer image view of its pattern.

6.113 Nevertheless, although it introduces bias into the image capture, it is recommended that where the choice is between photographing a well marked and a poorly marked female, choose the well-marked individual because there is a greater prospect of achieving identifiable recapture.

6.114 At other times of the year, images have been collected opportunistically during site visits principally designed to count seals assembled at haul-out sites.

Relative merits of equipment

6.115 All equipment has proved extremely vulnerable to malfunction and accident at all sites where seals were found. Sites can always be expected to be damp. There is usually a risk of getting grit on to the equipment via the hands or places where the camera is rest. There is usually the risk of stumbling or falling and of the camera suffering traumatic impact as a consequence.

6.116 Because of the hostility of the environments where seals are found, maximum care has to be taken to protect photographic gear against the spectrum of misadventures.

6.117 Whether manual focussing or auto-focussing is used is a personal choice. In this survey, manual focussing was preferred on most occasions.

6.118 The great majority of images catalogued were captured using the Canon EOS 20D digital SLR camera and the Nikon Coolpix cameras. However, significant numbers of images were captured using the Nikon F301 and F501 camera bodies with the 70-300mm. lens. All were captured using colour transparencies - Fujichrome or Kodakchrome (100 and 200 ASA).

6.119 Flash units proved to be the least reliable items of equipment used in this survey, due to malfunction, accident and battery failure.

6.120 A collection of images was captured using the camcorder. Generally, when used in combination with a Kowalski torch in the sea caves, it was the most successful means of collecting images of left, right and head-on profiles of seals (although the digital SLR camera was not available for comparison at that time).

6.121 In the way seals position their bodies and in the way they may move toward the sea, it is mainly only a single profile that is likely to be offered to the observer, although there are (usually) brief opportunities to view the other profile. Under these conditions, it was found easier to focus the camcorder than to focus the SLR.

6.122 It was also apparent that successful results are much more likely to be captured when at least two people are involved, one using the camera, the other pointing a torch at the subjects and making written or Dictaphone records.

6.123 If the seals are undisturbed, or mainly fairly still, the camcorder with a 400mm. lens is likely to prove itself a favourite tool where images can only be captured at distance. It can be focussed on an assembly and left to run, or it can zero in on individual seals. This technique free the fieldworkers to seek out other sub-assemblies on the same site where, for example, seals are assembled in several groups on a site, such as at Menawethan in the Eastern Isles of the Isles of Scilly and beaches north of Boscastle.

6.124 Be aware that it is easily destroyed. A camcorder that was lightly splashed by a seal early in one fieldwork cycle proved to be irreparable, as well as being very expensive to replace.

6.125 At open beach and island sites, the digital single lens reflex camera was strongly preferred to all other equipment, especially when used with the back-up of a camcorder running throughout the photo-session.

6.126 In all situations, the ideal was to have at least two people working in partnership, one using the camera of choice, the other operating the camcorder. At these sites, any equipment is used to best effect when attached to a tripod or rested on a bean-bag, the latter being the better option, so long as it can be kept from getting wet. This is because it is more helpful to the efforts of the fieldworker to remain concealed.

6.127 After the end of the fieldwork phase, but before all of the images had been catalogued, experiments were made using a digital camera at close quarters at sea cave sites. This proved comparable in effectiveness with the camcorder, but for the delay when a flash is used. This

delay often allowed the seal to move and so the intended image was not captured. Nevertheless, it proved useful and, to date, the most reliable tool.

6.128 The main reasons for capturing poor and inadequate quality images was camera movement, the movement of seals at the moment the image was being captured and the effect of environmental conditions (wind and precipitation).

Scanning the images

6.129 Prior to the electronic scanning of print and transparency images, a selection process by eye is required.

- A preliminary sifting sees the elimination of images of poor or otherwise inadequate quality.
- The remaining prints should be set out on a large table. On the reverse side of each image, a number should be written, as well as the date and code for the location at which the image was captured.
- Matching left and right profiles should be made with reference to the video record of the photographic session. This assists in keeping track of individuals that move.
- Sets of images of the same seal can be compiled during a second scan. The ideal is to have the head and neck of the target seal filling the frame showing the left, right or head-on profiles.
- For some seals, only one image will have been collected. The images are now ready to be scanned digitally.
- Where transparencies have been assembled, a preliminary weeding process should remove poor quality images. On the plastic frame of each image, a number should be written, as well as the date and code for the location at which the image was captured.
- The remaining transparencies should be run as a slide show. Two projectors are required at this stage, to be run side by side, to search for matching images.

6.130 The images are now ready to be scanned digitally.

6.131 Digital images can be transferred direct to the computer file from the memory card, having first deleted inadequate images.

6.132 The editing process will follow the scanning.

Encoding the images

6.133 Every image must be coded, the code representing:

The location

This uses a variable number of digits signifying the both locality and the specific site. An example is the code for Pentargon Seal Hole at Boscastle, Cornwall: BOSpsh.

Date of photograph

This uses six consecutive digits. An example is the code for the third of June, 2006: 030606.

Profile code

This signifies whether the shot is of the left, right or head-on profile. It uses one digit. Examples are L for left, R for right and H for head-on.

Signify sex (or age, if thought to be immature) of seal

This uses one digit. An example is M for male, F for female, I for immature.

Signify if the individual is known to be a seal mother or a male attendant at the nursery grounds

Examples are mother for the female and attmale for the male.

Signify the sequence of shots known to be of the same seal

Use a simple two-digit number: 01 for the first image, 17 for the seventeenth. Each section of the code should be separated by a hyphen.

6.134 The whole may appear as follows: BOSpsh-030606-L-F-mother-04.

Photographs demonstrating photo-identification methods

(from the Study of the Disturbance of Grey Seals in south Devonshire - Westcott 2006)

Plate 8 Left, right and frontal pelage markings of female seal frequenting the Mew Stone rocks during the survey period

Plate 9 Left and right profiles of second female frequenting the Mew Stone rocks during the survey period

Plate 10 Left and right profiles of third female frequenting the Mew Stone rocks during the survey period

Plate 11 Mew Stone female displaying heavily and distinctively scarred snout as well as vivid markings

It is not always pelage markings that are the surest way of identifying individual seal.

Plate 12 The immature seal (Tiger), showing left and right profiles, as well as the very distinctive tiger patterning on the dorsal surface

Plate 13 Left and frontal views of male frequenting the Mew Stone rocks during the survey period

Plate 14 Common seal, seen regularly during the survey period, here hauled out on Flat Skerries

The snout is shorter than in the grey seal and the pelage markings are more speckled that the blotched marking of the grey seals. In sunlight, the pelage was bright bronze when dry.

7 Procedural guidelines: examining seals-fisheries inter-actions

7.1 The views and recommendations presented in this section with respect to the culling of seals are not those of Natural England and should, therefore, not be attributed to Natural England.

Introduction

7.2 There is an age-old conflict between fisheries and seals because both seek to exploit fish stocks, albeit not always the same species.

7.3 Conflicts have intensified since the 1960s and 1970s, since when the use of plastic nets became commonplace. The efficiency of (often computer-enhanced modern fishing methods, in addition to the improved fishing gear, has resulted in the depletion of fish stocks by over fishing leading to a reduction in fleet size and in the number of people working in jobs associated with the fishing industry. The effect of over exploitation of fish stocks has been that commercial fishermen have become concerned about what were once regarded as peripherals: boats operating out of local harbours taking people on angling trips, and the impact of seals on local fisheries.

7.4 In the same period, public opinion secured an end to overt commercial seal culling in the UK, although fishermen retained the right to shoot seals seen in the vicinity of their nets under the Conservation of Seals Act (1970). However, large numbers of seals continue to be killed or harmed by fishing nets in southwest waters in what amounts to a continuing, albeit accidental, 'ghost' cull of seals. In part, it is the capture rate of these seals in their nets, especially bottom set nets that informs the attitudes of fishermen toward seals.

7.5 The conflicts in the southwest continue to be most intense in inshore waters, where there are periodic reports of seals taking fish (especially anglerfish) from fixed, bottom set nets, especially tangle and trammel nets. At the same time, a 'ghost' cull of seals (and harbour porpoises, who often forage in the same area, just above the benthos) continues, with large numbers of seals taken as accidental bycatch in fishing nets every year (Westcott, 2000).

Background

7.6 In recent decades, the ability of fishermen to locate and capture target stocks, using a variety of plastic-based fishing nets and techniques that are guided by fish finding technologies, has been enhanced.

7.7 There are hardly any grounds that a fisherman cannot now fish.

7.8 However, this extraordinary enhancement of their ability to catch fish has threatened the survival of the stocks they are exploiting and of jobs in the fishing industry. Politicians representing local economic and social interests at international negotiations have repeatedly watered down advice from fisheries scientists designed to help fish stocks achieve recovery.

7.9 In other international negotiations, the effects of global warming - particularly sea temperature rise and variations in currents on the distribution of fish species, their stock structure, movements

and inter-actions with other fish species - are described and bemoaned without mitigating actions being taken.

7.10 The effect of the concentration of toxins in the water column in the surface layer and at and in the benthos is also critically important, with part of the life cycle of so many species being spent in those areas.

7.11 Since receiving a measure of legal protection from the UK Parliament in 1914, the grey seal population has increased enormously. In recent decades, the perception has been of an ever-increasing grey seal population, with a parallel increase in annual pup production, to the point that the current grey seal population of the UK may be about 125,000.

7.12 However, according to SMRU - whose responsibilities include providing annual estimates of populations and pup production - the population is no longer increasing rapidly and the rate of pup production has slowed.

7.13 In southwest England, conflicts between fisheries and seals appear to be localised, despite the fact that two of the most important fishing ports in England (Newlyn and Brixham) are situated in the region. However, at present, the intensity of any such problem is exclusively described by fishermen without being subjected to scientific scrutiny. Typically, there is a brief flurry of concern expressed through the media, accompanied by a plea for something to be done. Conservationists rally to the defence of the seals at such times. Officially, nothing is done. A residue of frustration and bad feeling remains.

7.14 Traditionally, there were local ‘battues’ where men used to club seals to death at local sites. Between 1934 and 1951, there was a seal cull at sites in Cornwall, annually reported on by the Chief Fisheries Officer that resulted in the recorded deaths of 744 seals. Since the introduction of plastic fishing nets, especially since the deployment of tangle and trammel nets, there has been a (mainly) unrecorded bycatch of seals that can be regarded as an annual ‘ghost’ cull.

Seeking a solution

7.15 This section describes what should be done before conflicts arise and when they are flagged up by fishermen (as a result of suffering catch losses to the seals) or by the general public (reporting dead seals on southwest shores).

Assessing current and potential conflicts between fisheries and seals

7.16 Comprehensive detail must be gathered in order to achieve baseline information about:

Fishing effort

- Who represents fishermen’s interests?
- How many and what type of commercial fishing boats are operating from which bases on the coasts of southwest England?
- What (range of) nets are being deployed by each vessel?
- What are the target species and what species constitute bycatch?
- How many fish and what tonnage of fish is landed where each year by each type of fishery and each fishing boat?
- What quotas or other measures regulating fisheries are in place?
- How are regulations enforced and to what extent is enforcement effective?
- What conflict exists between different fisheries, for example between potters and trawler men?

- What support do the fishermen receive?
- Where is conflict experienced with marine mammals, especially seals, in what form?
- Is there any incidence of seal damage to fishing gear in any of the fisheries? If so, what is the extent of the damage?
- How many seals or cetaceans do each boat take each year as bycatch?

Seals

- What are the regional and local trends in grey seal numbers?
- Where are the favoured foraging areas of the seals of the region?
- If the favourite foraging areas have not been identified (by the use of Satellite Relayed Data Loggers or Mobile Phone tags, deployed by SMRU), where do the major assemblies of seals gather ashore through the year, does this suggest seasonal movements (for example, east or west) and is there any correlation with fishing effort.
- Is it possible to identify particular seals making repeated visits to net sites?

7.17 Having identified areas of concern or conflict, the following actions must be taken:

Where a conflict has been flagged up

7.18 At the outset, precise information on what has happened is likely to be scant. In the past, even in 2006, typically it has caused conflict between those engaged in fishing effort and those whose primary interest is orientated toward the conservation of seals.

7.19 Both parties display a tendency to go public. Most recently, fishermen have tended to call more for some form of birth control for seals rather than calling for a cull, although this is not a universal viewpoint. Opinions are posted. The dust settles. The problem goes quiet until the next eruption.

7.20 Whether or not there is a significant problem, it will not be resolved in this fashion.

7.21 If fishermen are losing catches to seals, this should be subjected to scientific scrutiny. An observer must go aboard and monitor what is happening over a number of trips. Where damage is being caused to nets or captured fish, it should be filmed and photographed as well as being quantified. Similarly, where bycatch occurs, that should be filmed and photographed as well as being quantified.

7.22 It is imperative that the observer has a detailed understanding of the local fisheries, of the biology of the target species and of grey seals and harbour porpoises (who utilise similar foraging areas in southwest England, as elsewhere).

7.23 It would be sensible if the observer is a competent seaman and if all parties agree to keep the survey work private, away from the public eye and especially from the media, whose raison d'être is to tell stories.

7.24 Where seals or porpoises are observed in the vicinity of the fishing area, they should be photographed or filmed, in an effort to establish their identity.

After the data have been collected

7.25 Can any measures be deployed to mitigate the conflict, for example by changing the target species or varying net types (if that is an option)?

7.26 It is very unlikely, with regional seal numbers being so low, that a cull would be authorised.

7.27 The facts should be copied to SMRU for advice.

7.28 However, in the current context, it is difficult to see how fishermen suffering economic loss might find recompense or satisfaction for their losses - except where the independent observer confirms their grievances.

8 Procedural guidelines: databases

Summary

8.1 Two centralised databases are required to store the information collected on grey seals. One must be designed to contain site-specific information. The other must contain seal-specific information.

8.2 Both databases will be directly comparable with the databases established for CCW in North Wales (Bangor) in 2002. There, an MS Access database was set up to record information about seals at every site where they occur and throughout the entire year. Data collection and research undertaken on behalf of Natural England should conform to Natural England's requirements to ensure compatibility with GIS systems and allow appropriate access of data to all Natural England staff.

8.3 The second database is described in the Procedural Guidelines chapter 'Tracking seal movements by photographic identification' (above).

8.4 However, it is advisable that local databases (both the site-specific and seal-specific databases) be maintained for those localities where regular observation of sites is being undertaken. Indeed, continuous localised observation could lead to the further development of the database design over time.

Site-specific database

8.5 The data to be included here are:

Site data

- A site name.
- A site reference number.
- Ordnance Survey co-ordinates.
- A photograph or set of photographs of the site. This is particularly important for sea caves, where fieldworkers are (currently) likely to find that the GPS unit does not function. Where sea cave entrances are situated close together, it is essential to have identified the shape of the entrance from the outset, in order to avoid confusion.
- A description of the site. This will describe the key features (for example, substrate types, depth of tidal pools at low tide, concealed seal resting places that might be overlooked). Attached to this will be a general description of what is known of what use seal's make of the site (rest, nursery, moulting).

Access data

- Describe how access to the site can be achieved and describe the degree of difficulty involved.
- Indicate the location of the nearest boat and wave ski launch points to the site, including Ordnance Survey co-ordinates. If the launch site is tidal, include detail of the nearest site where a boat can be launched at all states of the tide. If a launch fee is payable or if permission to use the launch site is required, include contact and fee details.

- Describe the navigation hazards to be found between the launch sites and the seal site.
- Indicate any potential havens or places of shelter between the launch site and the seal site. Where such places form part of the shoreline, indicate whether there is access to cliff tops via tracks or footpaths.

Plan view

- An annotated map of the site and, if appropriate, of the approaches to the site, should be drawn approximately to scale with the key features (for example, substrate types, depth of tidal pools at low tide, concealed seal resting places that might be overlooked) identified. If the site is a sea cave, a plan view will be drawn, to contain the same data here described. Points of access (from land and/or sea) and of specific observation points on-site or overlooking the site will be identified.
- The favourite resting places of the seals will be shown on a smaller inset version of the same map.

Site uses and impacts

8.6 Here, 'site' is used to include the adjacent waters. Therefore, data will be compiled under two headings and will always include an estimate of the distance, volume and timing of the human activity from where the seals are assembled:

On shore

- Much used by people for leisure activities.
- Rarely used by people for leisure activities.
- Not known to be used by people.
- Overlooked from land open to the public (such as the coastal footpath, car parks, and harbour walls) from which people typically notice the seals.
- Overlooked by the coastal footpath, from which people typically fail to notice the seals.
- Overlooked, visited or subject to disturbance from one of the following activities:

a) Seal watchers.
b) Anglers.
c) Eco-tourism operations.
d) Climbers.
e) Coasteers.
f) People landing from boats including canoes.
g) Coastwatch look-out.
h) Coastguard look-out.
i) 'Explorers'.
j) Other (describe).

- Military use (specify).
- Evidence of physical damage.
- Subject to wash from passage of boats (specify, for example, high speed ferry).

Offshore

- Fisheries: setting pots.
- Fisheries: netting.
- Fisheries: angling.
- Fisheries: scalloping.
- Collection: bait digging.

- Collection: algae.
- Collection: tiling for crab bait
- Aquaculture: fish
- Aquaculture: shellfish
- Aquaculture: algae.
- Extraction: sand or gravel.
- Extraction: oil or gas.
- Military use (specify).
- Recreational: eco-tourism operation.
- Recreational: dive site.
- Recreational: angling from boats.
- Recreational: coasteering.
- Recreational: motor boats being used for leisure.
- Recreational: canoeists.
- Recreational: sailing.
- Recreational: surfing.
- Sewage discharge.
- Waste dumping.
- Litter sink.

Survey event

8.7 The final element of the database is a record of every survey event for every site.

- The first batch of data identifies the date and the period of time spent observing the site. Times of high and low tide are included, along with the tidal height at those two extremes. Weather data included will be wind direction and speed (using the Beaufort wind scale), with sea state also being described (using the Beaufort sea state scale).
- The second batch of data describes separately the number of male, female, immature and sex- and age-unidentified seals present (under the heading ‘indeterminate’). There is additional space to include notes, making reference to specific details felt to be important (for example, if the seals were moulting).
- The third batch of data is to describe pups. Every pup receives a unique number for that locality and that year. A date of birth is assigned to the pup, based on frequency of site visits and physical features (such as presence or absence of the umbilical thread and whether or not the placenta is warm). Boxes will be ‘ticked’ if the pup has pelage marks, moves from one site to another, if it is observed swimming, if it is weaned, if it is moulted and if it is found dead. Another box exists to give the age in days of the pup.

8.8 There is also a section for notes.

- The final batch of information for the event describes any disturbance or other events of note.

8.9 Disturbance events are recorded under two headings:

On shore

- Fishing activity.
- Collection activity (bait, algae, tiling, derelict fishing gear)
- Recreation activity:

a) People on the beach, via the land, engaged in leisure activity.
b) People landed on the beach from boat.

c) Canoeists.
d) Personal Water Craft (eg Jet ski riders).
e) Climbers.
f) Coasteers.
g) Eco-tourism party.
h) Seal watchers.
i) Fly tipping.
j) Other (specify).

Offshore

- Fishing activity.
- Extraction activity (oil, gas, sand, gravel).
- Aquaculture activity (fish, shellfish, algae).
- Recreation activity:

a) Divers.
b) Canoeists.
c) Personal Water Craft (eg Jet ski riders).
d) Motor cruisers.
e) High performance power boats.
f) Sailing boats.
g) Eco-tourism operation.
h) Seal watchers.

Seal-specific (photo-identification) database

8.10 See Chapter 6: Procedural guidelines: tracking grey seal movements by photo-identification.

8.11 As noted above, both databases (site-specific and seal-specific) must be held centrally, being updated at monthly intervals with inputs from wherever local-based seal studies are being conducted.

8.12 The seal-specific database must be available centrally not only to inform coastal managers in the southwest but also to be shared with any larger scale study of seals, for example conducted under the auspices of INTERREG or Sea Mammal Research Unit.

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Appendix 1: (Partial) Health and Safety protocol used by Sea Mammal Research Unit (2005)

Fieldwork in general

This code of practice should be used together with "Guidance Note: Safety in Fieldwork" (NERC, 1997).

The Fieldwork Planning Form (which must be completed before any fieldwork) will identify the Senior Officer in the party. He/she is responsible for ensuring that:

a) all those taking part in the fieldwork expedition (particularly new recruits, volunteers and casual workers) are acquainted with the relevant codes of practice before departure from St Andrews;
b) these codes are adhered to;
c) there is at least one qualified first aider and one qualified load handler in the fieldwork party;
d) the basis for all decisions involving safety which are made during the expedition is documented; and
e) a regular, preferably daily, contact with the SMRU office is maintained.

All accidental injuries, significant accidents or dangerous occurrences/near misses sustained during fieldwork or incidents which could have lead to injury should be reported immediately to the Senior Officer or his/her deputy at the time of their occurrence, and recorded in detail as soon as possible. All reports should be entered into the Accident Book on return to St Andrews and on the appropriate University accident forms. The University Safety Office should be informed as soon as reasonably practicable.

The Senior Officer should appoint one member of the party to provide instruction on handling of heavy or awkward loads before loading of vehicles begins, and to supervise the packing of vehicles and trailers. The handling of large or heavy loads must be shared, and appropriate lifting equipment should be used when available. The Senior Officer should ensure that the loading limits of vehicles and trailers are not exceeded, that heavy items are stowed on the floor and that the load is evenly distributed. A properly secured cargo net should be placed over all lose items.

The Senior Officer is also responsible for ensuring that risks associated with driver fatigue are minimized. Driving responsibilities should be rotated amongst all qualified drivers, and there should be regular breaks for all passengers. The total daily hours of working (including both fieldwork activities and driving) should not exceed those recommended in the NERC driver's manual.

If any SMRU personnel travel long distances alone by car they should either take the SMRU mobile phone or make arrangements to check back with the office (or a colleague if out of office hours). For these purposes any journey taking more than 2 hours might be considered ‘long’.

Work in small boats and inflatables

Introduction

This code of practice should be used together with Appendix 12 (small boats, inflatables, hovercraft and amphibians) of "Guidance Note: Safety in Fieldwork" (NERC, 1997).

Every member of the Unit who works with small boats and inflatables should have completed a RYA boat handling course, or some equivalent (at the discretion of the Safety Advisor). Every project leader involved in boat work should have an advanced powerboat Qualification and have undergone VHF telephony and First Aid training.

Where more than one boat or a shore party is required as part of the fieldwork programme, the Senior Officer should appoint deputies who are responsible for safety procedures when he/she is absent. At least one member of the crew of each boat participating in a fieldwork programme should have attended a RYA course and be capable of navigating during conditions of poor visibility. In exceptional circumstances a member of the Unit who has at least 5 years experiences of work in small boats as part of the Unit's research activities but who has not attended an RYA course may be substituted. Such an arrangement should be agreed between the Senior Officer and the Head of the Unit before the fieldwork party leaves St Andrews.

Before departure from St Andrews, the Senior Officer should be satisfied that the boats and all associated equipment to be used during fieldwork are serviceable, seaworthy and in certification. He/she should confirm that all items on the attached Boating Equipment List are packed and in good condition, and that permission to land at all the sites to be visited has been obtained.

Equipment

- An up-to-date set of charts and tide tables for the area to be visited should be carried and the Senior Officer should be satisfied that all members of the party can read and understand them. In inshore waters around the UK, Ordnance Survey maps are often more useful than nautical charts.
- Read Appendix 20 (Communications) of the Guidance Note. Each boat and shore party should carry a two-way marine band radio and a spare battery. One member of the crew of each boat and shore party should hold an appropriate radio operator's licence or equivalent qualification. All members of the party must be instructed in the correct use of the radios. If one or more boats are operating some distance offshore, a more powerful VHF transmitter in a waterproof housing should be carried and a whip aerial for use with this should be mounted on the boat's transom.
- All members of the party should carry appropriate clothing (see Appendix 2 of the "Guidance Note Safety in Fieldwork") and have a personal set of wet weather clothing. Remember that it is often a lot colder out at sea than on land. If working during the winter or in a cold climate consider wearing an immersion suit.

Operational procedures

- Under no circumstances whatsoever should any member of the party put to sea alone.
- Boats should be assembled under the supervision of the Senior Officer. One of the deputy officers should then check that the boats have been assembled properly.
- A member of the party with lifting qualifications should supervise the transport of assembled boats and engine to the water and their subsequent launching and loading. The Senior Officer is responsible for making sure that a sufficient number of people are available for this task.
- Before departure each day the Senior Officer, or his deputies, should ensure that all spares and safety equipment on the Boating Equipment List are placed in the boat box provided with each boat, and that this box is securely lashed in place. He/she should also ensure that all engines are functioning properly, that any faults that have been notified have been rectified, and that each boat is carrying sufficient quantities of fuel in the appropriate mixture.
- Before departure the Senior Officer should be satisfied that weather conditions will be favourable during the entire time the party will be at sea. Do not risk being caught out. While operating in UK waters, at least one member of the party should be deputized to listen to the inshore weather forecast each night and report on this to the Senior Officer. If this has not been heard the coastguards should be contacted for weather information.

- The office should be notified in advance of work and personnel and regular contact with the coast guards should be ensured (see 5.3.5).
- Before the party sets out each day, the coastguard should be informed where the party is going and how long it will be at sea. The coastguards should be notified of the party's safe return by telephone or marine band radio. If possible a regular radio schedule should be established with another boat or someone on shore.
- When only a single boat is being used ensure that two serviceable engines are carried at all times. Use either two larger engines mounted side-by-side on the transom or carry a small emergency engine lashed safely within the boat.
- Before departure each day the Senior Officer should ensure that every member of the party is wearing a properly adjusted life jacket, and knows how to inflate it in an emergency, and that all members of the party are carrying personal flares or a strobe beacon.
- Do not smoke in boats.

Fieldwork involving the handling of seals or work in seal colonies

Introduction

This code of practice should be used together with Appendix 4 (work in seal colonies) of "Guidance Note: Safety in Fieldwork" (NERC, 1997).

All work that involves the handling of seals, other than routine tagging and weighing, is covered by the Scientific Procedures (Animals) Act 1986. The Senior Officer is responsible for ensuring that all those who carry out this work have an appropriate personal licence and that the procedures described in the relevant project licence are executed exactly as described in that licence. He/she should also ensure that all members of the party are clearly briefed on their responsibilities and the risks that may be involved.

Remember that the health and welfare of the study animals must have the highest possible priority. The techniques used by SMRU have been developed to minimize the risks to the animals involved. All work in the field should have clear, agreed objectives and be planned to minimize disturbance.

Wear appropriate clothing and footwear. Seal colonies are usually wet and cold places, conditions underfoot may be very slippery. Beware of the risks from exposure or falls.

Ensure that the party has adequate means of communication with the mainland in case of accident or illness (see Appendix 20 of the Guidance Note). For remote sites ensure that arrangements have been made for communication with advisors at the Robert Gordon Institute in Aberdeen in case of a medical emergency.

If the party is likely to be on a colony for more than a few days, sufficient food to allow a wide margin of safety should be taken. A spare tent and radio should be taken and stored well away from the main living accommodation in case of fire.

Lone working on islands is especially dangerous. Any member of the field party who goes for a walk on his or her own should inform the Senior Officer of his or her plan route and itinerary, agree on a time when he or she is expected back, and on an emergency procedure if they do not return on time.

Particular risks

- Seals are large and powerful carnivores that can move surprisingly fast (particularly over rocky or slippery terrain). Even the youngest pup can give a nasty bite. Wear loose clothing and stout gloves when working with animals. All members of the fieldwork party should maintain constant vigilance for their own safety and that of their colleagues. Avoid walking alone through a colony or group of seals. Carry a stout pole for your own, and others,

defence. Fieldwork parties should always carry a first aid kit with them when they are in a seal colony.

- Seals carry a number of pathogens that can cause illness in humans. The Senior Officer should ensure that all members of the party are aware of the risks from these pathogens. In particular, you should beware of the risks from "seal finger", clostridium infection and brucellosis (see below). Wear surgical gloves when handling seals. Ensure that any open wounds or abrasions are dressed and protected before handling an animal. Wash your hands in an antiseptic solution (preferably one containing Hibithane or a similar surgical antiseptic) as soon as possible after you have finished handling an animal.
- If someone is bitten, clean and dress the wound immediately and complete an accident report. Consult a doctor about the wound as soon as possible. Keep a careful check for infection that could lead to "seal finger", this is characterized by swelling around the joint nearest to the wound. If such swelling occurs, treatment with Terramycin should begin immediately.
- Brucella species have been found in marine mammals from around the UK and the disease is transmittable to humans, probably via aerosols. The symptoms are transient pyrexia (fever), flu-like symptoms and sinusitis which all respond to treatment with antibiotics. More details are included in the guidelines entitled "Notes on the prevention of infection from diseases of sea mammals" which can be seen in appendix 6 of the 1996 Strandings Report seen at the following weblink: http://www.strandings.com/Graphics%20active/1996%20Annual%20Report.pdf [Accessed September 2008].

Appendix 2: Year-round grey seal (*Halichoerus grypus*) abundance and distribution at inshore sites near Lands End, Cornwall, England; 1994-1996

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 3: Grey seal abundance at Longships Reef, June to August 1998

Summary

Longships Reef has long been known as an important haul-out site for grey seals. As early as 1667, John Ray was writing: '*On the rock called the Longships, they often, in calm weather, find the phocae, which they call soiles, sleeping, which sometimes they kill, by striking across the snout with a Pole and at others they shoot them. Some of them (they say) grow to the size of a bullock of two years old, and they are of divers colour. We could not certainly learn whether they have four or only two legs: one that said he had often killed them affirmed them to have only two legs and them before*'.

This series of counts, made between mid-June and the end of August, completes an initial impression of seal abundance and distribution in the Lands End locality. The Longships Reef appears to be a favourite summer haul-out site when sea conditions are calm or slight. At other times, the swell creates conditions in which seals cannot haul-out or maintain position there did they succeed.

Most seals use landward-facing, low-lying sites to the south of the lighthouse.

Introduction

The reef emerges as a series of large islets with associated skerries spread over 600 metres of seaway, about 2 kilometres west of Lands End. One of the largest islets, Carn Bras, supports the Longships lighthouse.

A historically and currently important but remote seal haul-out site, it was the one important site omitted from the 1994-1996 survey of inshore sites used by the grey seals in the Lands End district. This survey belatedly corrects the impression there presented that summer seal abundance is low.

Methods

Previous casual observations of seals hauled out at the Longships sites indicated that, in the absence of moderate or rough seas, and of disturbance, the largest number of seals were hauled out around the time of low water.

The 1998 observations of the site were made from the RSPB hut at Lands End, by a volunteer using a telescope. The counts, as elsewhere, represent the minimum number known to be present. Some seals may have been concealed by the topography.

At Longships Reef, 10 different, mainly low-lying sites, were used by the seals in the central part of the reef, just to the south of the lighthouse, facing to landward - being sheltered against the oceanic fetch by the highest islets of the reef.

These sites were used only when sea conditions were calm or slight, up to Beaufort sea state 4.

Results

When sea conditions permit, around the period of low tide, the Longships Reef continues to provide seals with remote and secure sites for them to haul-out and assemble ashore.

The largest (minimum) seal count was made on June 17, when 33 seals were seen.

15 or more seals were counted on 26 of the 50 days that counts were made. This signifies that Longships Reef remains one of the most important summer haul-out sites in southwest England.

Table A Longships Reef: total seal counts, June - August 1998

June	**14**	**15**	**16**	**17**	**20**	**21**	**22**	**24**	**29**	**30**
	12	22	22	33	05	02	18	09	09	19

July	**01**	**02**	**05**	**06**	**07**	**08**	**09**	**11**	**13**	**14**	**15**
	17	03	04	02	13	25	21	09	10	09	18

July	**17**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**
	03	12	05	24	11	24	20	16	20	20

August	**02**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**
	16	04	28	16	16	20	11	23	13	20

August	**13**	**16**	**18**	**19**	**20**	**24**	**25**	**26**	**27**
	14	17	03	01	15	09	10	23	16

Discussion

The seal counts represent only a minimum count of seals. Some seals may have been concealed by the formations of the rocks. Others may have been missed at such a great distance due in part to environmental conditions.

Recommendations

The regional importance of this site is hinted at by this study and can only be clarified by building a long-term data set of seal counts. This could be undertaken by a volunteer or group of volunteers. The RSPB volunteer working at the hut might be persuaded to make observations (as was the case here). Or it might be that a member of staff at Lands End could make the low tide counts. However, the key element in this would be the quality of the telescope, which should be of the best.

It would be interesting to carry out year-round remote monitoring of seals at this site, in relation to sea conditions and air temperature, supplemented by occasional site visits to clarify sex and age ratios.

References

RAY, J. 1667.

Appendix 4: Grey seal pup production in the Lands End district; the timing of the southwest England breeding season described for the first time

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 5: Grey seal pup production at two localities in west Cornwall (Lands End & Godrevy); 1996-1998

Please contact Natural England (Truro office) to access this information and obtain the full report.

Telephone: 01872 245045.

Appendix 6: Isles of Scilly Grey Seal (*Halichoerus grypus*) breeding season; sites used for pup production, timing and number of pups born, the identity of adults present and observations of disturbance, 15 August to 26 September, 2005

Please contact Natural England (Truro office) to access this information and obtain the full report.

Telephone: 01872 245045.

Appendix 7: Notes and references on nursery sites and pups of the southwest region

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 8: Additional notes on the timing of the season of pup production at different localities in southwest England

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 9: Additional notes and references on seal assembly sites in the southwest region (including some moulting sites)

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 10: The seal caves of Cornwall & Devon

Please contact Natural England (Truro office) to access this information.

Telephone: 01872 245045.

Appendix 11: Seals and Fisheries; Interactions in Cornwall & the Isles of Scilly (May 2000)

Please contact Natural England (Truro office) to access this information and obtain the full report.

Telephone: 01872 245045.

Introduction

For the past several years, Cornish and Isles of Scilly fishermen have been reporting an apparently increasing problem of fish captured in their nets being damaged by grey seals. In particular, they report damage to the 'tails' of monkfish, that part of the fish that has a particularly high commercial value.

This problem was first examined by Delphine Glain in 1998, as part of her M.Sc. Dissertation in Conservation at UCL. Her findings are included in this report.

This study has sought to examine the precise nature and location of the problem. Fishermen were interviewed. Trips to sea with those who are suffering most acutely are being made currently. Fishing methods and the recent history of the affected fisheries are described. The biology of the monkfish was investigated, along with the extent of knowledge of stock size and breeding areas in southwest waters. The status of grey seals in Cornwall and the Isles of Scilly was examined, and the extent to which they are protected under the laws was described. The role of the National Seal Sanctuary was examined.

The report concludes with recommendations.

Appendix 12: The disturbance of grey seals (*Halichoerus grypus*) at haul-out sites

A report for English Nature (Truro) on the extent to which they suffer disturbance at two haul out sites in south Devonshire, on what causes it and how it can be reduced, September 2000.

Please contact Natural England (Truro office) to access this information and obtain the full report.

Telephone: 01872 245045.

Summary

At haul out sites in south Devon, a small population of grey seals is subjected to considerable levels of disturbance, mainly resulting from the activity of people in boats of various types. At one site, some disturbance results from people walking over rocks to see them from closer quarters. At both sites, it appeared likely that much disturbance was inadvertent, brought about by lack of awareness of how wild seals would respond to their approach. There was some deliberate disturbance at both sites.

Numbers of seals using the two sites studied dwindled during the period of study and the behaviour of seals at the more regularly disturbed site became particularly nervous and alert.

Recommendations are made which would, if taken up, ameliorate current levels of disturbance.

Appendix 13: A study of the disturbance of grey seals (*Halichoerus grypus*) at two localities in south Devonshire, England; the (Dart) Mew Stone archipelago and Peartree Point skerries

Please contact Natural England (Truro office) to access this information and obtain the full report.

Telephone: 01872 245045.

Executive Summary

In 2000, an investigation was carried out at two south Devon sites, the (Dart) Mew Stone and Peartree Point, into whether or not the grey seals using them were subject to disturbance caused by people.

It concluded that both sites were subject to considerable disturbance. At the Mew Stone, it was caused mainly by the activity of boats close to the rocks upon which seals were assembled. At Peartree Point, it was caused mainly by people swimming and snorkelling in the sea or by people clambering over rocks close to the seals, as well - to a much lesser extent - by boat activity.

Recommendations were made for both sites, designed to mitigate disturbance levels and reduce them to the barest minimum.

The greater effort was made at the Mew Stone site because the sources were exclusively from the sea. Most important of these was that the low water lagoon area between and north of the Shooter Rock and the Shag Stone be designated a voluntary exclusion zone, excluding boats including kayaks and also divers.

The Mew Stone recommendations were discussed by all affected parties (including representatives of the fishing community, pleasure and private boat operators), as well as being attended by representatives of the police, the Dart Harbour Navigation Authority and of conservation bodies. Here, it was unanimously agreed that the exclusion zone be created. The agreement was widely publicised, on television, radio and in regional and local newspapers.

At Peartree Point, the main recommendation involved informing the public of the sensitivity of the site via a leaflet available at the car park serving that site and Start Point.

The current study reviewed the efficacy of the recommendations and agreements achieved in 2000. The main finding is that there was a lack of follow-up, to ensure that the agreements remained in the forefront of the attention of the local boating public. This is the responsibility of the author.

This study also re-visited the survey work carried out in 2000, examining residence time of seals on particular rocks, monitoring the behaviour of seals on the rocks by the use of activity budgets, recognising the identity of individual seals, describing the choreography of every observed disturbance event at both sites.

An addition to this study that had not been a feature of the 2000 study was that two questionnaires were devised, a collaboration between Susanna Curtin and Steve Richards of the University of Bournemouth and the author.

One questionnaire was designed to explore the views of passengers being carried on the 8 wildlife cruises to see the seals run by the author. The second was designed to explore the views of walkers at both sites, but primarily at Peartree Point. A component of both questionnaires entailed researching the views of the public to a variety of management measures, in order that their views be represented in any subsequent debate of the recommendations made in this report.

Due to logistical problems brought about by the under-funding of the study, the main research effort had to be concentrated at the Mew Stone by a solitary researcher (the author). However, the identities of male, female and immature grey seals were established, using photographic identification. This showed that the particular seals using these sites varied little over the 3-month survey period. Their natural behaviour was studied throughout, in order that seal-seal disturbance could be separated from disturbance caused by people in boats. They used precisely the same sites as were being used in the 2006 survey. In addition, a low water count of seals, differentiating between males, females and immatures, was made for every site visit in order to measure fluctuations in site use through the period. The counts showed that grey seals were present in slightly higher numbers than during the 2000 survey. There was also a vagrant visitor, in the form of a male common seal, throughout the survey period.

At the Mew Stone, an alarmingly high incidence of 56 disturbance events was recorded in the 60-day study, the largest proportion of which occurred in late May and June. 39% of these events occurred as a result of boats entering the lagoon exclusion zone, very similar to the 37% of events recorded for 2000, suggesting either that people were not aware of the status of the lagoon or that they elected not to observe it, which was the case in a number of the events. As in 2000, seals showed absolutely no tolerance for the proximity (sometimes as far away as 100 metres) of kayakers or divers. Their presence close by deterred seals from hauling out on that tide.

The questionnaire results showed that the watching of marine wildlife is at the top of a complex mixture of reasons given for taking a wildlife cruise. However, there is strong support for the continuation of the boat exclusion zone at this site. Furthermore, respondents indicate not only that observations should be conducted from afar (generally, farther than proposed in the Recommendations (see below)) but also for only a limited duration of between 5 and 10 minutes.

The most powerful endorsement for any feature of this questionnaire was for an accreditation scheme for marine eco-tourism operators. Although not specifically stated, the implication was that respondents would like to have the opportunity to support operators who are ethically based in their relationship to wildlife. This implies the importance of making the public aware of such a scheme in order that they may make use of it.

At Peartree Point, seals used haul-out opportunities on a higher proportion of days in 2006 (every day: 100%) than in 2000 (c.85%).

Perhaps because of the relatively greater number of days spent hauled out by the seals in 2006, the percentage of days when disturbance occurred was greater in 2006 than heretofore. However, there was a striking change in the number of seals disturbed in the course of the 12 disturbance events observed during the 15 day observation period. In this survey, the impact of snorkellers was disproportionately great, in that they disturbed more than half of seals caused to enter the sea as a direct result of human activity. Although their impact was confined to just three specific events, their impact was dramatic by comparison with any other form of disturbance, with almost two-thirds of all seals disturbed being disturbed by their activities. Fewer disturbances were caused by snorkellers in 2000, when a similarly dramatic impact was made on large numbers of seals.

Boats also generated some disturbance here, but the least tolerance was shown for kayaks.

The responses to the questionnaire show that the seals play an important role either in attracting people to Peartree Point or in enjoying their time there. In watching the seals, most people caused no disturbance to them at all and favour measures to protect them against disturbance. Where they had noticed seal disturbance events, these had been caused by boat activity, snorkellers and the presence of dogs - something not recorded by the Earthwatch observers during their survey work

Anecdotal information was communicated indicating that there have been instances of seals being shot at these haul-out sites.

The principal lesson learned in the course of this study was that recommendations need to be followed up strongly not just in the succeeding year but also thereafter.

Natural England works for people, places and nature to conserve and enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas.

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