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Report of the Working Group on Seabird Ecology (WGSE)

3–7 April 2006

Texel, The Netherlands

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Contents

1 Executive summary

The Working Group on Seabird Ecology (WGSE) met for five days from 3–7 April 2006 in Texel, The Netherlands, and was attended by sixteen persons from ten countries (Annex 1). Thirteen were nominated members of the group and three were invited by the WG Chair to attend this year’s meeting. During the meeting WGSE was able to address all the terms of reference, though in varying detail and the results are reported here.

Identifying and delineating protected areas for seabirds have become an important issue during the past years. WGSE explored the different approaches taken by designating Special Protection Areas (SPAs), following the EU Birds Directive, and Important Birds Areas (IBAs) according to Birdlife International. Both concepts are presented in this chapter, as well as many scientific and practical issues involved. Further on, overviews of recent developments in nine countries are given.

Seabird reproductive performance was extremely poor in the northwestern North Sea in 2004 and partly so in 2005. WGSE gives an overview of which species were affected and to what extent, and also whether signals of worse breeding success were visible in other parts of the North Sea and Scotland. Furthermore, possible explanations for the decrease in reproductive output are explored.

Closely connected to the chapter above, and following on from discussions on the Ecological Quality Objectives for seabird populations at the 2004 WGSE meeting, recommendations were developed on which monitoring activities need to be carried out to understand seabird population trends. This includes definition of priorities, selection of species and parameters, and an overview of sampling design approaches. A brief account of current monitoring activities in the ICES area is presented, highlighting that a more thorough survey of current activities via a questionnaire will be useful.

Information on diet of seabirds has been essential not only for exploring many topics in seabird ecology but also for input into multispecies models. As a variety of methods exist that investigate diet qualitatively and quantitatively, WGSE developed an overview of the different methods and their respective advantages and disadvantages. Apart from the methods involved, the different details and formats of the results of such studies vary substantially and a start was made to develop recommendations on how these might be standardised. This will be completed at the next WGSE meeting.

In addition to these four main terms of reference, WGSE also dealt again with the EcoQO on plastic particles in fulmars. WGSE followed the suggestion to slightly alter the parameter for future monitoring activities. Furthermore, WGSE explored the option to publish another Cooperative Research Report and suggested alternative approaches to disseminate information gathered by this group.

2 Introduction

2.1 Participation

The following members of the Working Group on Seabird Ecology (WGSE) participated in the meeting (see Annex 1 for full information).

Tycho Anker-Nilssen	Norway
Pep (J. M.) Arcos	Spain
Rob Barrett	Norway
Thierry Boulinier	France
Kees Camphuysen	The Netherlands
John Chardine	Canada
Morten Frederiksen	UK
Stefan Garthe (Chair)	Germany
Ommo Hüppop	Germany
Mardik Leopold	The Netherlands
Manuela Nunes	Portugal
Ib Krag Petersen	Denmark
Iván Ramírez	Portugal
Norman Ratcliffe	UK
Jim Reid	UK
Richard Veit	USA

Thirteen persons were nominated members of the group; three persons were invited by the Working Group Chair to attend this year's meeting. The possibility to appoint persons not yet nominated by national delegates was considered by the group to be an extremely useful tool.

2.2 Terms of Reference

The 2005 Statutory meeting of ICES gave the Working Group on Seabird Ecology the following terms of reference:

a) review the current approaches for identifying offshore seabird aggregations and delineating Important Bird Areas (IBAs) and Special Protection Areas (SPAs);

b) review the breeding success of seabirds in the northwestern North Sea in 2004 and 2005 and explore the reasons for the poor performance;

c) produce recommendations for a comprehensive monitoring programme for seabirds;

d) produce recommendations on how to sample diet and how to report results of dietary studies in seabirds, and provide diet information to SGMSNS for multispecies modelling work;

e) determine potential for a state of the art report as a *Cooperative Research Report*, and report to LRC.

Furthermore, a request from OSPAR on the EcoQO on plastic particles was passed on to WGSE to comment on a possible change in the metrics.

Because of the substantial work load related to the first four terms of reference we were not able in all cases to include all aspects as we wished. Thus, at the beginning of the respective chapters, information is given on how it was dealt with the respective terms of references.

2.3 Note on bird names

Throughout the text we provide common English names for bird species. A full list of both English and scientific names is given in Annex 4.

2.4 Acknowledgements

The Working Group wishes to thank the Royal Netherlands Institute for Sea Research for providing us with a meeting room, copying and computer facilities and for other valuable logistic support. The Group also thanks Kees Camphuysen and Mardik Leopold for making the local arrangements for our meeting. We furthermore thank the ICES Secretariat for information.

3 Current approaches for identifying offshore seabird aggregations and delineating Important Bird Areas (IBAs) and Special Protection Areas (SPAs)

The delineation of Important Bird Areas (IBAs) and Special Protection Areas (SPAs) has become an important tool for nature conservation in Europe and elsewhere in recent years. The application of these concepts to marine areas has started relatively late and is not straightforward due to various reasons. In this chapter, we outline the different issues that are most relevant for recognition of IBAs and SPAs at sea. Within the restricted time available at the WGSE meeting it was not possible to cover all aspects in as much detail as needed. Instead, this version should be treated as a discussion document outlining the most relevant topics. It awaits completion at the WGSE meeting in spring 2007.

3.1 Introduction

3.1.1 Definitions

There are several types of protected areas for a variety of marine system components. In the marine environment, the abbreviation MPA, if/when used here, merely denotes any marine protected area. Very often, however, a MPA would refer to an area at sea that is protected primarily for habitats or fish stocks. The principal instrument in the European Union for the classification of important habitats is the Habitats and Species Directive (EC, 1992). This piece of legislation provides not only for the designation of sites for important habitats for the whole range of organisms including birds, but also sites for most taxa. Such sites are known as Special Areas of Conservation (SAC). A related piece of legislation, the Birds Directive (EEC, 1979), provides for the protection of birds. So, under the Birds Directive, a Special Protected Area (SPA) is an area specifically classified for its important bird interest.

Together, SPAs and SACs are known as Natura 2000 sites. There may be political as well as practical conservation benefits to identifying sites that qualify as both SPAs and SACs.

An Important Bird Area (IBA) also denotes an area that hosts birds in significant concentrations. However, there are notable differences between the designation SPA and the accolade IBA.

Articles 4.1 and 4.2 of the Birds Directive require that Member States classify “the most suitable territories in number and size as special protection areas” for those bird species included in Annex I of the Directive and also for regularly occurring migratory species of bird, taking account of their protection requirements at sea as well as on land. The SPA concept therefore is a legally binding one: failure to classify SPAs for important bird populations by Member States of the EU carries the risk of legal proceedings being instituted against those Member States. SPAs are defined by applying criteria devised by state governments or their advisors.

The concept of an Important Bird Area applies globally rather than just within Europe. IBAs carry no legal weight; areas accorded such status are assessed using criteria compiled by non-government organisations, principally BirdLife International and its partners.

In practice, there may be a great deal of overlap between SPAs and IBAs, certainly in the broad areas so identified if not their exact boundaries (for example, RSPB 2005). Such an overlap is reinforced at a European level where a specific category within the IBA criteria was adapted to the EU bird populations (category C). Both these types of protected area aim to protect discrete concentrations of birds. What constitutes a discrete concentration as opposed to a widely dispersed pattern of birds is a question of scale, and ultimately the distinction to be made becomes a subjective judgement. However, that is not to say that concentrations may not be identified using “objective” and repeatable methods that result in operational definitions that can be applied in consistent ways (see below). The important point is that the protection requirements of species must be addressed. Depending on the nature of species dispersion it is sometimes important to fulfil these requirements via site designation and sometimes through wider conservation measures. In fact, in most cases it will be desirable to combine site-specific, species-specific and activity-specific approaches to guarantee the protection of the species.

3.1.2 Guidelines and criteria for identifying SPAs and IBAs

Compilation of a network of SPAs in the marine environment has reached only a relatively early stage across Europe; the focus over the past three decades has been firmly on terrestrial, freshwater and inter-tidal sites. In the absence of prescriptive advice from the EU, rules and guidelines for the identification and classification of SPAs across the European Union have varied across Member States. However, many states have adopted similar approaches. Given that the process is now fairly well established for terrestrial/freshwater/inter-tidal habitats over most of the EU, and also for the reasons of consistency, there has been a presumption that those guidelines formulated for non-marine environments should, as far as possible, be applied to the marine environment. Hence, little distinction has been made between the two environments, though simple transposition of the terrestrial model into marine areas is not without its difficulties (see Section 3.1.3).

Guidelines that have been applied to determining whether sites qualify as SPAs, certainly in those EU Member States that have made significant progress in compiling a suite of SPAs, tend to specify that specific proportions or numbers of relevant populations be represented within the sites. For example, areas that are used regularly by 1% or more of the national or biogeographical populations of species in any season, or that host particularly high densities, or contain more than 20,000 waterfowl or seabirds in any season, are deemed as meriting classification as SPAs. Notwithstanding this, there always remains scope for applying judgements based on other sorts of (reliable) information on species’ ecology and life histories. A more comprehensive outline of SPA qualification guidelines is contained in Stroud *et al*. (2001) and EU (in prep.).

In contrast to SPAs, the criteria used to assess whether a site qualifies as an IBA, are universally applicable. Again, these criteria are expressed in terms of 1% thresholds of relevant populations including flyways, and numbers of individuals (with 20,000 again being the preference). There is also a significant emphasis on the perceived threat or conservation status of the species. In common with the SPA issue, the IBA criteria were devised specifically with regard to bird populations inhabiting terrestrial, freshwater and intertidal habitats. Their application to marine ecosystems faces similar difficulties (see below). See BirdLife International (2005) and SPEA–SEO/BirdLife (2005) for full details of IBA criteria.

It will be clear that while the two concepts are very similar and share common purposes, SPAs and IBAs differ in their respective philosophical provenances. Both the IBA and SPA (or networks thereof) identification processes will be tempered by political considerations, on the one hand by non-government/lobbying organisations whose principal remit will be the strict protection of birds and their habitats, and on the other by state governments whose objectives might be influenced by wider political concerns. In any event, the elevation of sites to IBA or SPA status should as far as possible be done by applying sound scientific practices.

Inasmuch as no generic, prescriptive rules exist across the EU for the identification of SPAs. Governments may choose whether or not equate their IBAs with SPAs. While consistency of approach across the EU might be desirable for many reasons, it is perhaps not possible politically.

3.1.3 Problems with applying standard criteria to marine areas

Although the IBA and SPA criteria have been developed for all biomes, most aspects were derived from experiences on land and in the coastal zone, with the latter usually been viewed from a land perspective. For that reason there are specific problems when dealing with birds at sea.

1. Information on distribution and abundance of birds at sea is not as good as that for birds on land. Studies of seabirds at sea started late compared to most habitats and areas on land. Substantial progress has been made in the North Atlantic over the past three decades though, and many marine regions are now quite well known (e.g. North Sea). However, seasonal constraints tend to result in more bird surveys being conducted in summer than in winter months and coverage varies according to distance from shore. Many areas (at small scales of analysis) have been surveyed infrequently if at all, and therefore represent “snapshots” of marine bird distribution and abundance. This means it is difficult to determine whether sites are used consistently or ephemerally. Furthermore, sea areas are vast and remote from land and thus there are hardly any options to sufficiently cover such areas even once. The Macaronesian Sea and the northwest Atlantic are two such examples.

2. The activity range of seabirds – although very variable – tends to be much larger than on land, even if compared to birds of prey that have rather huge territories. Chiefly, the extent of spatial use of the seas is related to foraging activities and migration. In contrast to most birds feeding on land, foraging activities of breeding seabirds may reach as far as several hundred kilometres from the colonies as in the case of most procellariiforms (Shealer, 2002). Because of such ranges, it will be difficult to include such extensive foraging ranges into an IBA/SPA perspective. However, many species have much shorter foraging ranges, especially terns and auks (e.g. Pearson, 1968; Garthe, 1997). For wide-ranging species, most foraging areas may very likely be disconnected from the seabirds’ colonies, thus requiring independent protection.

3. Seabirds generally have dispersed distributions but some species in some circumstances do associate with habitat features (see Section 3.3.1). However, such habitats are often comparatively large-scale and the site boundaries rather indistinct and often also mobile compared to terrestrial, freshwater and intertidal areas. This results in relatively low spatial stability in seabird concentrations, which makes site-based conservation difficult, especially at smaller scales.

3.2 Methods of data collection

Recognition of IBAs and SPAs depends on identifying sites where birds occur and the numbers of birds associated with these, and this requires data. Data can be collected specifically to identify SPAs or IBAs or data on distribution and abundance from other sources (e.g. Environmental Impact Assessments for windfarm or oil developments) can be collated and used for this purpose. Specifically collected data has obvious advantages, since scales and coverage surveys can be designed to address site recognition. However, coverage and scales from other surveys can be adequate for this purpose, in which case lengthy and expensive survey work can be avoided. In some cases, gaps may exist in available data which need to be filled by dedicated survey, in which case the two sources of data are complementary.

There are two broad methods of collecting such data on seabird distribution and these are described in the following sections.

3.2.1 Transect survey

Open waters are too extensive to allow complete counts of birds inhabiting them, such that a sampling of densities followed by extrapolation has to be employed. Transect counts are the most common means of sampling seabird density at sea. This provides data on the population scale, with the distribution of a large proportion of the population being described if the survey area is adequately wide and resolution sufficiently fine.

There are two main types of transect surveys. Strip transects use a fixed transect width, within which all individuals are supposed to be detected. A strip width of 300 m is the often used. Line transect surveys use observations from a wider transect width that is subdivided into distance bands to estimate densities. The decreasing detection probability with increased distance away from the survey track line is used to fit a detection function using Distance Sampling (Buckland *et al.*, 2001). A crucial assumption is that all birds are detected on the innermost transect line. Transect data are usually computed as birds per km^2, and presented as "post", density grids or contour plots.

Counts can be made from ships or aircraft, and evaluation of the two platforms can be found in Camphuysen *et al*. (2004). Aerial surveys allow rapid coverage of large survey areas and access to shallow areas or complex coastlines, whereas boat surveys are more suitable for offshore areas or restricted waters. Identification and detection of cryptic species (auks, storm-petrels) is more difficult from aircraft than from a boat, although easily flushed species (such as divers and seaduck) may flee from slow moving boats before they are counted whereas fast-moving planes are able to detect them as they take flight.

The advantages of transect surveys are that they are able to sample distribution of a large proportion of a population if coverage is sufficiently wide, and that estimates of numbers within areas can be tentatively calculated. The main problem with transect surveys is that they only provide information of distribution within the area covered, and where coverage is incomplete biases in assessment of distribution and relative importance of areas will result. Furthermore, the provenance of birds is unknown, which is problematic when assessing the importance of areas for birds from particular colonies or populations. Similarly, transect surveys fail to provide information on the age class (only for some species) and the breeding status of the birds observed. Finally, as the technique is visual, no data are obtained at night and distributions of some birds may exhibit diel variation.

3.2.2 Tracking individual birds

Tracking involves fitting devices to individual seabirds that store or transmit data that can be used to determine their locations at sea at varying time intervals. A general rule applies that the device should not be heavier than 5% of the bird's body mass (Cochran, 1980) which restricts it use on small species. A variety of devices are available for this purpose and these are described below.

Radio-tracking involves fitting birds with a radio-transmitter, and the signals from this can then be detected by an antenna. This allows the location of a bird to be determined by triangulation from fixed points (Freeman *et al.*, 1997; McSorley *et al.*, 2005) or by following them by boat (Ostrand *et al.*, 1998) or plane (Adams *et al.*, 2004; Mañosa *et al.*, 2004). Radio-tracking is relatively cheap, and transmitters can be as small as 1g, such that tags can be fitted to even the smallest seabirds. However, detection range is often limited to an order of tens of km, depending on transmitter size and height of the receiving antenna. As such, they are only suitable for determining foraging range of relatively inshore species unless individuals are followed by an aircraft, or rafting areas of pelagic species (McSorley *et al.*, 2005) around colonies.

Platform Terminal Transmitters (PTTs, also known as satellite tags) transmit position data regularly to orbiting satellites and hence to the observer and so can be detected at any point of the globe without the need for retrieval, allowing wide-ranging, pelagic seabirds to be tracked. Accuracy is relatively high, with an error of usually few km at most (Wilson *et al.*, 2002). Until recently, PTTs were heavy and bulky and so could only be fitted to large birds such as albatrosses (Jouventin and Weimerskirch, 1990) and penguins (Davis and Miller, 1992). The size of these devices has decreased substantially in recent years (9g), which allows deployment on medium-sized species such as some shearwaters. However, PTTs are still too heavy for small species such as terns and storm-petrels.

GPS loggers calculate positions from to orbiting satellites and store these. They provide the highest accuracy available, but have to be retrieved to download the data. Size constrains have limited their use to large species such as albatrosses (Weimerskirch *et al*., 2002) and Gannets (Camphuysen, 2005), but improvements in power of storage and reduced size could make GPS loggers very useful tracking devices in the next few years. Combined GPS-PTTs merge the high accuracy of the GPS system and do not need to be recovered to obtain the data.

Global location loggers carry an internal clock and register light intensity, from which daylight duration and sunrise and sunset hours, and hence latitude and longitude, can be calculated. This technique is relatively cheap and easy to conduct, though it is necessary to recapture the tagged birds to download the stored information. Precision is low (tens of km), and it is best recommended to employ these loggers for wide-ranging species and also for wintering behaviour rather than foraging area identification while breeding.

Compass loggers have two or three compasses along with an internal clock. From the heading of the compasses and the flight duration a paths can be reconstructed. Flight routes of species exhibiting relatively straight flights and not showing too many changes in activity (e.g. gannets) are much easier to reconstruct than those from species turning very often and changing activity very frequently (e.g. kittiwakes). Short time intervals between data logging increase the accuracy of the flight route.

The advantage of tracking is that it can provide accurate data that covers a seabird’s global range that is not bounded by arbitrary survey areas (as transect surveys may be). Remote-sensing techniques also allow the provenance of birds in different areas to be assessed and reveal information on seabird movements during the night. The disadvantages are that tags are expensive and so the number of birds and colonies at which they can be deployed is limited. As such, distribution may not be representative of the population as a whole owing to variation in ranging behaviour according to colony, age, sex, breeding status, individual and season.

Transect methods and tracking can be complementary with both methods providing independent data on distribution, tracking revealing provenance of birds and transect counts providing estimates of numbers (Camphuysen *et al*., 2004).

3.3 Determining boundaries of areas

Boundary recognition is a fundamental process relating to IBAs and SPAs in order to determine the spatial limits of the site. There are several means of achieving this that depend on whether habitat or bird distributions are being used as the basis for site recognition, and the types of bird data available for analysis.

3.3.1 Use of habitat features

Marine systems may outwardly appear homogenous, but do contain various habitat features that birds associate with at elevated densities (e.g. Hunt and Schneider, 1987). Where birds associate strongly with a habitat feature, its limits may be used as an SPA or IBA boundary in the same way as in terrestrial, freshwater or intertidal systems.

Habitat features that may be important for boundary determinations are oceanographic features such as bathymetry, temperature and salinity.

Marine habitat features have been mainly used on the designation of MPAs worldwide (Hyrenbach *et al*., 2000), and also for SACs within Europe. These have potential to complement seabird conservation where important numbers occur within their boundaries. For example, the SAC Dutch Coastal Sea designated to protect shallow sandbanks encompasses important concentrations of seaduck (Lindeboom *et al*., 2005; Section 3.5.3), and that for the Friesian front post-breeding concentrations of guillemots (Leopold *et al.*, in press; Section 3.5.3). It has also been recently proposed to use hydrographical clues to identify MPAs protecting the breeding foraging grounds of the Balearic Shearwater (Louzao *et al*., in press; Section 3.5.6).

MPAs centred on habitat features are often surrounded by buffer zones, which are intended to allow for dispersal of animals associated with it or, in the case of hydrographic features, uncertainty in the location of the feature itself (Hyrenbach *et al*., 2000). SPAs and IBAs do not include provision for buffer areas around sites.

3.3.2 Delimiting marine extensions to colony SPAs and assessment of foraging areas

Colonial nesting seabirds are central place foragers, and many species are highly aggregated in discrete colonies. As such, the distribution of breeding seabirds tends to be more clumped and spatially stable during the breeding season than at other times of year. Furthermore, many of the most important seabird colonies are already recognised as IBAs and designated as SPAs, but these generally only extend to the high water mark. Marine extensions to such colonies may therefore have merit for protecting bathing, resting or foraging areas upon which birds breeding at the colony depend for survival and successful reproduction, and various approaches exist to delimit the boundaries of these.

Bathing and resting birds often congregate around cliff colonies at high densities that can be incorporated into the colony SPA using generic species-dependent extensions. Ship-based surveys of seabird distribution revealed densities of auks declined markedly at 1km from the colony and those of northern fulmar and northern gannet at 2km from the colony, and these limits were used to define boundaries for marine extensions to colony SPAs (McSorley *et al*., 2004). The seaward boundary of Manx shearwater rafts around three UK colony SPAs was determined from fixes of radio-tagged birds (McSorley *et al*., 2005; Box 3–1). However, most species feed beyond the boundaries of resting areas and such extensions will not recognise or protect important foraging areas.

The boundaries of foraging areas for breeding seabirds can be delimited most simply using foraging radii (Birdlife International, 2000). These can be determined from empirical observations of foraging ranges using tracking devices or transect surveys from ships as described in Section 3.2. Alternatively, the distance travelled can be calculated from trip duration and flight speed (Pearson, 1968) or from provisioning energetics (Flint, 1991), although these tend to overestimate range (Birdlife International, 2000). Foraging ranges vary enormously among species (Birdlife International, 2000), and so need to be applied generically to each important colony at which a species occurs (Table 3–1). However, foraging ranges can vary among sites (Hamer *et al*., 2000) and years (Monaghan *et al*., 1994) and this may result in generic boundaries being inappropriate. The main problem with this approach is that seabirds generally use a small proportion of their potential foraging range, and so large areas that are seldom used by birds will be included in the IBA or SPA when radii approaches are employed (Birdlife International, 2000). This problem is most acute for species with large foraging ranges such as petrels and gannets, for which radius based methods are wholly inappropriate (Birdlife International, 2000). However, for those with short foraging ranges and low foraging habitat specificity such as terns, this approach is worthy of consideration (Birdlife International, 2000).