



Guidelines for National Coordinators of the International Waterbird Census (IWC)

**Simon Delany
January 2005**

Step chart

To establish and maintain a national waterbird monitoring scheme, practitioners in each country should take the following steps:

- Step 1: Draw up a list of sites for standardised monitoring of non-breeding waterbirds.**
- Step 2: Assemble a hierarchical network of observers, volunteers and professionals, as appropriate and available.**
- Step 3: Apply International Waterbird Census (IWC) methods to the monitoring of sites in January each year.**
- Step 4: Consider the use of additional methods for monitoring species inadequately covered by standard methods.**
- Step 5: Create a computer database to allow management and use of the information collected.**
- Step 6: Ensure that optimum use is made of the information collected.**
- Step 7: Feed results into conservation policy.**

Introduction

These guidelines are a summary of the waterbird monitoring practices at national level that are most appropriate for international conservation efforts. Conservation practitioners involved in waterbird monitoring at national level should follow the guidelines to enhance the quality of information available for international waterbird conservation. This document is based on Guideline No. 9. in the Conservation Guidelines published by the African-Eurasian Migratory Waterbird Agreement (AEWA, 2004) titled "Guidelines for a waterbird monitoring protocol".

Aims of waterbird monitoring

The main purpose of waterbird monitoring is to obtain objective, detailed and accurate information about the conservation status of each population of waterbird (see Box 1). This information forms a crucial basis for nature conservation policy at local, national and international levels.

Box 1: What is monitoring?

Monitoring is the measurement of variables over time with specific objectives in mind. The specific objectives of waterbird monitoring are the maintenance of baseline populations of waterbirds, and maintenance of favourable trends in waterbird populations.

The basis for much conservation action is provided by monitoring. Decisions about which waterbird species are most in need of conservation action, and judgement of the effectiveness of such action, can only be made if the numbers and distribution of waterbirds are closely monitored.

A large number of waterbird species are monitored in many countries in all seasons using a great variety of specific and generic methods. It is beyond the scope of these guidelines to summarise all these techniques and monitoring schemes. For information about many diverse monitoring methods, readers are referred to detailed manuals and handbooks, e.g. Gilbert *et al.* (1998) and Ecoscope (in press).

Numbers and distribution of populations

One of the most important uses made of waterbird count information is estimation of the number and distribution of individuals in different populations. As knowledge of waterbird populations increases, it becomes possible to set minimum baseline levels below which it is considered undesirable for populations to decline.

Priority species for monitoring are:

- globally threatened species;
- species listed in the Annexes of international Nature Conservation Agreements and Conventions
- at national level, species for which the country holds a high proportion of the population at some point in their annual cycle.

While intensive efforts should be made to monitor priority species, an important principle is that a similar effort should be made to monitor all other waterbird species. Whilst monitoring is able to provide information that is useful to the conservation of threatened species, a crucial aim is to monitor the fortunes of more numerous and widespread species for which even quite large changes in status and distribution might otherwise go unnoticed.

Population trends

Counts of waterbirds should be obtained on a regular basis, and in a standardised, routine manner. The frequency of counts should be regular enough to detect trends quickly. If this is done, it is possible to recognise the trends in numbers exhibited over time by different

Consultation draft

populations. This allows populations in decline, and those that are increasing, to be identified, and the rates of change to be estimated.

Conservation action for declining populations should be given the highest priority. Management in response to population increase may also be necessary.

Monitoring should continue in the long term, so that the consequences of any conservation or management actions are themselves monitored.

Identification of flyways and populations

For conservation purposes, waterbird biologists are increasingly studying birds at the level of individual populations and flyways. If key sites for each population throughout its life cycle can be identified (breeding, moulting, staging and “wintering” or non-breeding sites), the flyways used by different populations can be identified, and conservation of each population at a flyway level becomes possible.

Site importance

All waterbirds require a network of high quality sites for nesting, for moulting, for ‘refuelling’ during migration, and for surviving the non-breeding season. The best method of assessing the importance of a site for waterbirds is to organise regular counts of the waterbirds that use it. The overall numbers of birds and the proportions of each population at a site revealed by counting can then be used as an objective basis for assessing its importance.

Sites that are monitored should include:

- all sites designated under the Ramsar Convention as wetlands of international importance, and other sites recognised as being nationally or internationally important for waterbirds;
- as many additional sites representative of the country’s wetlands as it is possible to count on at least an annual basis.

The International Waterbird Census

For practical reasons, these guidelines concentrate on monitoring once per year in January using methods developed under the International Waterbird Census (IWC), co-ordinated by Wetlands International and its predecessor organisations since 1967. Waterbird monitoring already takes place in over 100 countries in the world as part of the IWC. The objectives of this Census are well established and the methods are very successful (see Box 2). Guidelines for census techniques that complement IWC methodology and cover species inadequately monitored by the IWC are included in Step 4. Some of these additional methods include monitoring of waterbirds outside the traditional January time window, but the emphasis of these guidelines is on monitoring for the January census.

Box 2: The International Waterbird Census (IWC)

Objectives of IWC:

IWC aims to contribute significantly to the conservation of waterbirds and their wetland habitats by:

- providing the basis for estimates of waterbird populations;
- monitoring changes in waterbird numbers and distribution by regular, standardised counts of representative wetlands;
- improving knowledge of little-known waterbird species and wetland sites;
- identifying and monitoring sites that qualify as Wetlands of International Importance under the Ramsar Convention on Wetlands;
- providing information on conservation status of waterbird species for use by international agreements;
- increasing awareness of the importance of waterbirds and their wetland habitats at local, national and international levels.

The IWC is sub-divided into four surveys at continental level:

- The Neotropical Waterbird Census,
 - The Asian Waterbird Census,
 - The African Waterbird Census,
 - The Western Palearctic and Southwest Asia Waterbird Census.
-
- The IWC began in Europe, North Africa and the Middle East in 1967.
 - Sites are counted in January, the month when inter-site movements by most waterbirds in the Northern Hemisphere are at a minimum. In sub-Saharan Africa, an additional July count is made.
 - In the first years of the IWC, most participating countries included only Anatidae (ducks, geese and swans) and Common Coot (*Fulica atra*) in the counts.
 - During the next 35 years, counting spread to more countries, and to additional groups of waterbirds.
 - By 2000, most participating countries were operating monitoring programmes that counted a majority of waterbird species.
 - High quality reports are produced which provide feedback to counters and give incentive to maintaining and expanding the census.

Step 1: Draw up a list of sites for standardised monitoring of non-breeding waterbirds

Many countries already conduct waterbird monitoring at a number of sites, and some, especially in Europe and Africa, have comprehensive waterbird monitoring schemes.

The first priority of any newly-established national waterbird monitoring scheme should be to select a sample of wetlands where it is possible to conduct annual counts in a standard way. These sites should be given the highest priority for counting each January, and also each July in sub-Saharan Africa. If resources allow, this sample of priority sites should be extended to include sites representative of all the wetlands in the country. The sample should include as many of the country's wetlands designated under the Ramsar Convention and as many other internationally and nationally recognised sites as possible.

By prioritising site selection in this way, the highest possible proportion of waterbirds will be counted.

Step 2: Assemble a hierarchical network of counters, volunteers and professionals, as appropriate and available

Successful waterbird monitoring at the international level cannot exist without good organisation at national and local levels. Waterbird monitoring schemes may be based in governmental or non-governmental organisations or research institutes, and may receive input from all of these types of body.

The best way to organise waterbird monitoring at a large number of wetlands in a country is through a hierarchical structure of organisation (see Box 3).

- A national co-ordinator is appointed who has overall responsibility for the census in the country.
- Local organisers (often volunteers) co-ordinate counts in different regions of the country.
- A number of counters (also often volunteers) are then responsible for counts at individual sites within each region of the country.
- At big sites, which are divided for the purposes of counting into a number of sub-sites, counters are organised into teams, and a site organiser reports to the local organiser.

This system of organising waterbird monitoring is extremely productive and cost-efficient. In many countries, voluntary counters contribute thousands of hours of highly skilled survey work every year, free of charge. Such voluntary effort is best organised professionally. Enormous value is added to the costs incurred by professional organisation where this system is adopted.

In countries lacking a tradition of hobby bird watching, a different approach is necessary. In these countries, annual expeditions by volunteer birdwatchers and conservation professionals from governmental and non-governmental organisations and research institutes cover a sample of priority sites.

Training

In countries where waterbird monitoring is still small in scale, the training of professional and voluntary counters should be undertaken as a high priority. Training should concentrate on two main areas:

- Field techniques (how to identify and count birds);
- Data management techniques (how to collect, store, analyse and interpret waterbird monitoring data).

Box 3: A National Waterbird Monitoring Network

This diagram represents a simple national waterbird monitoring network. Instructions and feedback flow down from the national co-ordinator, and count information flows up from the individual counters. This system is commonly adopted throughout the world. Professional input is often restricted to national co-ordination and the analysis and publication of results.

Wetlands International Co-ordinators



National Co-ordinators



Local organisers (Co-ordinate local areas)



Site Organisers (Co-ordinate big sites requiring many counters)



Individual counters

For international overviews produced under the International Waterbird Census, the national co-ordinators send all January counts to Wetlands International's co-ordinators in Wageningen, The Netherlands, Dakar, Senegal, Kuala Lumpur, Malaysia and Buenos Aires, Argentina.

Step 3: Apply IWC methods to the monitoring of sites for non-breeding waterbirds

The most important element of waterbird monitoring methodology is standardisation.

The top priority of National Co-ordinators should usually be to count the same sites in the same way every year. Comparisons between countries and years are then straightforward and valid. Counts at wetlands which vary in extent from year to year, such as ephemeral wetlands in arid areas, and sites which are particularly prone to freezing, cannot be standardised in this way, and at such sites, the top priority each season should be to count as many of the birds present as possible. Counts additional to the January and July (Africa) censuses are extremely valuable, and should be organised at national level when resources allow.

Field Methods

The methods used to count waterbirds in the field depend on many factors, for example:

- the species being monitored;
- the size of the site;
- the accessibility of the shoreline;
- the availability of vantage points from which the site can be scanned;
- the amount of time available to complete the count;
- the number of people involved;
- the available equipment.

Consultation draft

More details of field methods used for waterbird counting are to be found in the waterbird counters' manual produced as a companion to these guidelines for National Coordinators, titled *Guidelines for participants in the International Waterbird Census*.

- Many large or complex sites are divided into sub-sites for the purposes of counting. Each sub-site is a separate count unit. It is best if counting of sub-sites is closely co-ordinated and simultaneous, with one or more counters per site unit, especially at tidal sites where birds move around in response to the tidal cycle.
- Identifying the best vantage points can take a number of visits to the site in different conditions. The proportion of birds using a site that are registered by counts can be considerably improved by local knowledge of:
 - tidal conditions;
 - best light conditions at different vantage points;
 - periods of maximum disturbance;
 - other local variables which affect counting efficiency.
- Counts are usually made by scanning flocks of waterbirds (which usually comprise several species) with a telescope or with binoculars as appropriate. Flocks should usually be scanned several times, and birds counted one or two species at a time. If time allows, repeated scans can be used to obtain a consistent estimate, *i.e.* to improve the precision of the count. Scanning repeatedly has the additional advantage of maximising the chances of finding small, inconspicuous or rare species present in small numbers.
- A tally counter can be used to speed up this process and reduce errors. Some experienced observers use two or more tally counters simultaneously, and allocate a separate count of a different species to each.
- Large flocks introduce an inherent bias; small sites with few birds can be counted with greater accuracy than large sites with many birds.
- Birds should be counted one at a time at small sites. This procedure can be adopted at larger sites if there is no shortage of time. However, it is usually preferable to count faster than this to prevent problems caused by birds moving about in response to the tidal cycle or to disturbance.
- Experienced counters can accurately estimate 10, 20, 50, 100 or more birds almost instantaneously, and scan through flocks counting in these units with a tally counter. It is preferable to estimate in small units (10 is probably the most commonly used unit). Units of 100 or more are generally only used for birds in flight where time is very limited.
- Flocks of birds in flight are often best counted from the back of the flock, scanning in the direction of flight with binoculars or a telescope.
- Records should be kept in a notebook (using a pencil in case of rain), or recorded on a small tape recorder.
- Counts from boats may be suitable at some sites, for example lakes and rivers fringed with vegetation. Some of the difficulties with boat surveys include:
 - low vantage point;
 - the inability to use a telescope;
 - disturbance of birds caused by the boat.
- Aerial survey is the best method for counting extensive, inaccessible areas, for example offshore waters and extensive river floodplains. Some of the difficulties with aerial surveys include:
 - high expense;
 - the considerable practice required to produce consistent results at high speed;
 - a very specialised technique, for which a separate instruction manual was produced by IWRB (now Wetlands International Komdeur *et al.* 1992).

The importance of mapping sites

The mapping of sites plays a crucial role in successful waterbird monitoring.

- If possible, the total wetland area within each site should be counted. A map should be used at every site counted. The boundary of the area counted and any special vantage points used should be marked on the map. The main reason for this is to ensure consistency of coverage from year to year. When counters retire and new ones begin

counting a site, it is crucial that coverage continues as it did before. Copies of all site maps should be kept by local and national co-ordinators of every national waterbird monitoring scheme.

- The area counted by each observer is called a count unit, and may comprise a single, self-contained site, or part of a larger, complex site.
- The map should be checked before (and, if necessary, during) every count, and at complex sites counted by a team, the site co-ordinator should ensure that everybody knows precisely the boundary of the count unit for which they are responsible.
- If a site is subdivided and new sub-sites created, the new sub-sites should be sub-units of existing units, leaving the existing outer boundaries intact. The sum of counts in the new sub-units can then be compared with the pre-existing site when calculating population trends.
- Mapping is extremely important at temporary wetlands and those with boundaries that vary according to the extent of seasonal flooding. Similarly, the extent of freezing at wetlands in cold climates should be recorded.
- At sites designated as Ramsar Sites or having other international or national status (e.g. nature reserves), the boundaries should coincide with the boundary of the designated area wherever possible. If a larger area is counted than that designated, the designated area should be counted as a sub-site of the whole so that species totals for the designated area can be calculated.

Step 4: Consider the use of additional methods for monitoring species inadequately covered by standard methods

All waterbird species should be counted during the January IWC counts (and the July IWC counts in sub-Saharan Africa). However, not all waterbird species can be adequately monitored using the standard approach outlined above. The methods outlined in this step will monitor many additional species. Further methods, which are beyond the scope of these guidelines, can be found in books such as *Bird Census Techniques* by Bibby, Burgess and Hill. If obtainable, specialised handbooks and manuals are also extremely helpful, for example *Bird Monitoring Methods: a manual of techniques for key UK species*, published by the Royal Society for the Protection of Birds in the U.K. in 1998, and *A species and habitats monitoring handbook*, currently being produced by Ecoscope Applied Ecologists.

Waterbird species well covered by IWC methodology: Analyses of data from the International Waterbird Census have shown that standardised counts in January can be used to obtain adequate population estimates and trends for a majority of swans, geese and ducks (Anatidae), Common Coot *Fulica atra*, and many populations of grebes (Podicipedidae), cormorants (Phalacrocoracidae) and waders (Haematopodidae, Recurvirostridae, Charadriidae and Scolopacidae). IWC methods work well for these species because their populations often congregate at a relatively small number of sites during the non-breeding season.

Waterbird species best counted at communal roosting sites: Some species, for example geese (*Anser* spp. and *Branta* spp.), waders (Haematopodidae, Recurvirostridae, Charadriidae and Scolopacidae), herons and egrets (Ardeidae) or cormorants (Phalacrocoracidae) and gulls and terns (Laridae), form large, concentrated roosts outside the breeding season. Counts of some roosts, for example waders at high tide, may be included in the IWC methodology described above. Other roost counts, for example of geese, should only be undertaken as part of a specially organised monitoring scheme, to ensure that birds at the roosts are not double-counted at their feeding sites.

Colonially nesting waterbird species: Some species congregate at colonies during the breeding season, and closely co-ordinated counts at this time may be very productive. Many species in the following taxa can be counted at their colonies: pelicans (Pelecanidae), cormorants (Phalacrocoracidae), herons and egrets (Ardeidae), storks (Ciconiidae), ibises and spoonbills (Threskiornithidae), flamingos (Phoenicopteridae), and gulls and terns (Laridae). Many

successful surveys of colonial nesting waterbirds have been carried out at the national level, and it may be possible in future to produce international analyses for some species.

Waterbird species with very dispersed distribution: Some numerous species distribute themselves thinly over the available landscape. Typical examples are the Mallard *Anas platyrhynchos* and Egyptian Goose *Alopochen aegyptiacus*. Only a small proportion of the populations of these species is included in counts. If the assumption is made that the same proportion of the populations of these species are counted each season, count data can provide a basis for estimates of population trends, even if they shed little light on actual numbers. That is, as long as the under-estimate remains constant between years, the monitoring scheme can be applied to species where only a relatively small proportion of the total is counted.

Waterbird species that congregate away from wetlands: Many waterbirds use offshore habitats and habitats away from wetlands, such as farmland and rubbish tips. Offshore habitats are preferred by seaducks (e.g. *Somateria* spp. and *Melanitta* spp.), divers (Gaviidae), and some populations of grebes (Podicipedidae) and cormorants (Phalacrocoracidae). These species are best counted by aerial or ship surveys, which by their nature can usually only be conducted occasionally, for example every five years. Species making habitual use of farmland in the northern hemisphere include most species of geese (*Anser* spp. and *Branta* spp.) and Northern Lapwing (*Vanellus vanellus*). Other lapwings of the genus *Vanellus* are often found far away from wetlands in Africa, Asia, Oceania and South America. Many species of gulls *Larus* spp. occur in large concentrations at rubbish tips.

Waterbird species that congregate in the region outside the traditional January census period: The standard IWC methods, because they use data from the month of January only, miss important congregations of waterbirds during migration and other periods. Many Arctic nesting wader populations pass through Europe and Asia during spring and autumn migration *en route* to tropical and southern hemisphere wintering areas. It is very important that national programmes should include surveys during migration times to monitor these birds. Species such as Abdim's Stork in Africa and Oriental Pratincole in Asia and Oceania form seasonal concentrations that should be monitored if possible. The identification of key sites for species on passage should be included as an aim of national waterbird monitoring schemes wherever possible.

Waterbird species with skulking behaviour: Two groups of waterbirds well-known for skulking in dense vegetation, out of sight of observers, are the snipes (*Gallinago* spp. and *Lymnocyptes*) and most species of crakes and rails (Rallidae). Successful surveys of these groups pose particular challenges (see Box 4). As with widely dispersed species (see above), the assumption can be made that the proportion of these species missed by counts remains similar from year to year. It may therefore possible to use count data to obtain an indication of population trends of some species, although the absolute numbers remain unknown.

Box 4: Monitoring skulking species

Snipes (*Gallinago* spp. and *Lymnocyptes minimus*) are killed in large numbers by sport hunters. Hunting bags have been used to indicate the relative numbers of different species and variations in numbers from year to year. Shot birds can be aged, so that the proportion of birds of the year in the population can be used to give an indication of variations in breeding productivity.

Crakes and rails (Rallidae) are among the most skulking of birds, and many species remain very poorly known. Methods of monitoring need to be developed because at present, it is possible that even a catastrophic decline in some of these species would go unnoticed. Possible monitoring methods include intensive nocturnal surveys of calling birds during the breeding season. Detection rates could be increased by registering the response to playback of pre-recorded calls.

Waterbird populations that are hunted: Parts surveys, including wing and tail collections, can be used to monitor annual productivity, as well as age and sex compositions of wintering populations.

Threatened waterbird species: Special efforts are required to monitor rare and globally threatened species. Where threatened species are known to occur, special attention should be given to monitoring them at as many stages of their annual cycle as possible. Threats and potential threats should also be closely monitored.

Counts at wetlands affected by freezing, floods and drought: Many wetlands vary in their extent each season as a result of freezing, flooding or drought. A careful record should be kept of the extent of flooding or freezing each season, and of the extent of coverage achieved by counters. This information should be recorded on maps. The extent to which some species concentrate and the location of the main concentrations are closely related to the distribution and extent of these changeable wetlands each season. For example, the distribution of Garganey *Anas querquedula*, Ruff *Philomachus pugnax* and Purple Heron *Ardea purpurea* in West Africa depends largely on variations in the nature and extent of flooding each season. The distribution of Smew *Mergellus albellus* in Europe each winter is similarly affected by the extent of freezing in Northern and Eastern Europe.

Step 5: Create a computer database to allow management and use of the information collected

A number of commercially available software packages have made data management easier in recent years. Information about counts and sites is usually stored on a database, and spreadsheet, mapping, graphics and statistics packages are available which allow clear and simple analysis, presentation and interpretation of the information.

Recording Forms

Standard forms should be used to record waterbird count data. Many national schemes use their own recording forms, and Wetlands International produces forms for the International Waterbird Census for use in countries where organisers prefer this. See: http://www.wetlands.org/IWC/docs/census_proc.htm

- The form lists all waterbird species found in the country (except for very rare ones, which are added by counters on blank lines). Required information is, as a minimum, the name of the site, the date of the count and the number of each species counted.
- It is very important to record whether any waterbird species are present at a site but not counted. The design of the form should make it clear whether the lack of a count of a particular species is because the species was not present, or because it was not counted.
- Additional information relating to factors such as weather conditions, water level and disturbance may also be recorded.
- One of the most important tasks undertaken by national and local co-ordinators each year is the distribution of forms to the counters. This gives organisers the opportunity to discuss the season's counts and any anticipated problems.
- The local and national co-ordinators are responsible for retrieval of completed forms at the end of each season.
- After the season's forms are returned to national co-ordinators, they should be carefully checked, and have standard site codes added. The code is unique to each site, and the same codes should be used for the same sites each season.

Computerising data

- After forms are checked and coded, the information on them should be input to computer. It is vital that checks are carried out at this stage to ensure that inputting errors are minimised.
- The best way to minimise inputting errors is to type all data into the computer twice. One version is then subtracted from the other, and any inputting errors are revealed.

Consultation draft

- In countries that do not yet use computers to manage their data, the forms are sent directly to the international co-ordinators for computerisation.
- Countries that computerise their data should send them electronically to the international co-ordinators. Wetlands International advises national co-ordinators about the most appropriate software to use, and the best format for submitting the data for international analysis.

Databases

- Computer databases are used to store and summarise information collected by waterbird counters.
- Box 5 gives a simple example of a good way to summarise waterbird count information in database tables.
- Modern database software is very flexible. Additional tables linked to the table of counts may store information about counters' contact details, or conditions of weather and disturbance at the site during a count. It is also a relatively simple matter to export data to graphics or mapping software packages, or to perform statistical analyses when required.

Box 5: Example of a simple waterbird count database

Such a database might consist of a table with information summarised in columns (or 'fields') under the following headings: **site name**, site **co-ordinates**, **date** of count, **species**, number **counted**. A new row of the table is used to present each separate count of each species. An example of a database with this structure follows. To save space and typing, species codes are used:

site name	co-ordinates	date	species	count
West Lake	45°37'N35°47'E	150198	ANAPL	162
West Lake	45°37'N35°47'E	150198	FULAT	547
West Lake	45°37'N35°47'E	150198	CYGOL	38
Blue Bay	48°16'N32°58'E	160198	ANAPL	20
Blue Bay	48°16'N32°58'E	160198	TACRU	1

The computer software is capable of producing all kinds of different summaries of the data once it is entered in this table format. A database with this structure has the advantage of being very simple, but also the considerable disadvantage of repeating a lot of information. The site name and co-ordinates are repeated for every count of each species. If this simple database structure were used for summarising data at national and international levels, the amount of repetition would be enormous. Site details would need to be entered for every count of every species in every year, and computing capabilities would soon be overwhelmed.

It is much more efficient to create separate tables, one with information about the sites, the other holding the count information. This approach applied to the example above would result in tables that look like this:

Site table

site code	site name	co-ordinates
1234	West Lake	45°37'N35°47'E
5678	Blue Bay	48°16'N32°58'E

Count table

site code	date of count	species	count
1234	150198	ANAPL	162
1234	150198	FULAT	547
1234	150198	CYGOL	38
5678	160198	ANAPL	20
5678	160198	TACRU	1

The creation of an additional column, site code, on both tables, allows the information on the two tables to be linked. Site codes may be chosen by national organisers or at international level. The crucial feature of a site code is that it should be unique to the site, and that the same code should be used for each site in each season. Data forms should always be checked by national co-ordinators, and at this stage it is relatively simple to add the correct unique code to each form.

Consultation draft

Zero counts

If a site is visited and no birds are present because of drought, freezing or disturbance, for example, it is important that a zero count is recorded. Failure to do this will result in incorrect calculation of average counts for the site, and incorrect treatment of the site for population trend analyses (the trend analysis programme will assume that the site has not been counted and will impute missing values for the species usually counted at the site). If a site is destroyed and counts stop for this reason, it is similarly important to record this on the database.

Analyses at national or international level assume that all waterbird species present at each site are counted, and when performing calculations for population trend analysis, computer programmes insert a zero for species which are found in the region but which were not recorded during a particular count of a particular site. It is therefore important to make a note of any waterbird species which were present but not counted (as often happens in the UK with gulls, for which counting is optional, for example). It is simplest and best if all waterbird species present at a site can be counted on each and every visit.

Site consolidation

- At sites that are divided for counting into a number of smaller count units (sub-sites), each count unit is treated as an ordinary site and given a unique site code.
- A second code then needs to be generated for the entire site, to enable the software to consolidate all the different count unit totals from the site into one overall total.
- These consolidation codes also need to be unique, and a database table with two fields relating all site codes to their respective consolidation codes needs to be created.
- This can then be linked to the table of sites and the table of counts to generate site totals at the level of consolidated sites.
- If a site code is changed on the site database, every record relating to that site also needs to be changed on the count database. Some database software packages automatically make these changes through links established between the different tables.
- To be certain of retaining the integrity between the site database and count database for every country, each country should submit its total data set to the international co-ordinators, including information going back to the time when counts were first started, every year.
- This will obviously only be possible for countries which have well-established computerised data management systems for their waterbird monitoring schemes.

Local, national and international databases

- Local organisers should return forms to their national co-ordinator promptly each year, and the information should be entered into the computer at the sub-site level.
- All information relating to every count unit should be maintained.
- For international analyses, information is usually required at the level of consolidated sites, and it is most convenient for international co-ordinators to receive data from large, complex sites already consolidated.

Accommodating changes

National waterbird count databases change every year. The new season's counts are added, and it is usual for changes to be made to the site list because of new sites being covered. National co-ordinators should inform international co-ordinators about all changes to the site list. The simplest way to do this is to submit a new site list every year, together with the new year's counts.

Step 6: Ensure that optimum use is made of the information collected

Summary of numbers and distribution

National co-ordinators should submit data for international analysis within one year of the count date.

National population estimates derived from count information can be used as the basis for identifying nationally important sites. Sites regularly holding 1% or more of the national population estimate can be said to qualify as being nationally important for the population in just the same way as sites regularly holding 1% of flyway populations qualify as being internationally important. In some countries, using 1% as a threshold for national importance results in qualification of unacceptably large numbers of sites. In these instances, 2% or 5% may be decided by national interests to be a preferable threshold. Identifying sites on this basis should benefit national nature conservation policy, and should afford sites important for waterbird conservation some protection from development.

Identification of population trends

Simply comparing the number of birds counted in a country each year is not valid as an approach to trend analysis because of differences in coverage of sites from year to year. In order to identify population trends, it is necessary to achieve consistent coverage of a large sample of sites used by each population over a period of at least five years. A number of methods are available which make allowance for the missing values that result from changes in coverage of sites between seasons, but these methods can only be used if the number of missing values is relatively small.

Identification of key sites

Data from waterbird monitoring is used in the identification of key sites.

- Two of the Ramsar criteria for the identification of wetlands of international importance are based on the numbers of waterbirds present.
- It is relatively straightforward to extract sites that meet these criteria from the international databases, but the resulting lists are at present incomplete.
- Restriction of IWC data to the months of January and July (Africa) limit the capability of the international databases to identify key sites.
- Data collected at national level from other times of the year are therefore extremely important in the identification of key sites.
- It is highly desirable to organise national counts more than once a year, although the annual January and July (Africa) counts are the most important and should therefore be regarded as the minimum.

Identification of key sites for waterbirds away from wetlands, for example in the Arctic breeding grounds, is usually beyond the scope of national waterbird monitoring schemes. Important offshore areas may be identified by aerial and ship surveys.

Dissemination of results

Regular publication of results is very important in maintaining enthusiasm for waterbird monitoring among observers at national level.

- A regularly published (ideally annual) report should be produced, or results should appear annually in a widely available ornithological journal.
- These reports do not need to be long and complicated. Simple summaries of the total numbers of birds counted and comparison with earlier seasons may be all that is required.

Consultation draft

- An annual summary of results may reveal developments in the numbers of a particular species that require conservation or management action. If annual reports are kept simple, periodic reports with a more detailed analysis are desirable, for example every three to five years.

Step 7: Feed results into conservation policy

Different uses at different scales

At the local scale, information collected by waterbird monitoring is often used in site management and planning decisions and Environmental Impact Assessments.

Also at national level the information collected is used in planning decisions and Environmental Impact Assessments. Furthermore at the national scale, the information may be used by public inquiries into potentially damaging developments. Waterbird monitoring information also forms the basis of national designation of protected sites, and of Important Bird Areas (IBAs) recognised by BirdLife International.

At international level, waterbird monitoring information is used in support of the Ramsar Convention on Wetlands, and other international agreement such as the African-Eurasian Migratory Waterbird Agreement under the Bonn Convention, and the Biodiversity Convention, and is also used as a basis for regional agreements, species management plans and species conservation action plans.

The information gained from waterbird monitoring has additional value as an education and public awareness tool, especially in developing countries. The collection of new, baseline information about many species is a further valuable aspect of waterbird monitoring in the developing world