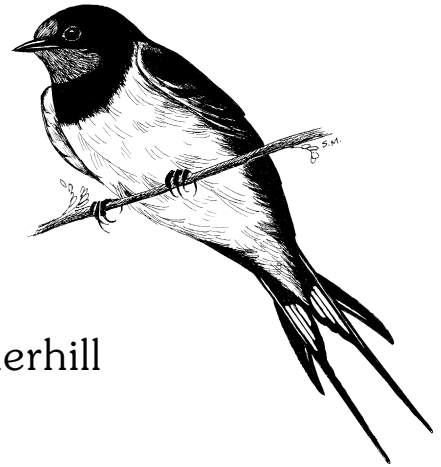
ADU Guide 5

SAFRING
Bird Ringing Manual

S.J. de Beer
G.M. Lockwood
J.H.F.A. Raijmakers
J.M.H. Raijmakers
W.A. Scott
H.D. Oschadleus
L.G. Underhill



Cape Town, July 2001

Avian Demography Unit

The Avian Demography Unit (ADU) is a research unit of the University of Cape Town. It conducts research in partnership with BirdLife South Africa. The ADU provides a channel through which birders can make a unique and significant input to the science of ornithology. BirdLife South Africa members form a network of observers who contribute data to projects coordinated by the ADU. The ADU produces the newsletter *Bird Numbers* twice a year.

The mission of the Avian Demography Unit is to contribute to the improved understanding of bird populations, especially bird population dynamics, and thus make a contribution to bird conservation. The Avian Demography Unit achieves this through mass-participation projects, long-term monitoring, innovative statistical modelling, and population-level interpretation of results. The emphasis is on the curation, analysis, publication and dissemination of data.

ADU Guides provide information on projects of the Avian Demography Unit at the University of Cape Town.

Birders interested in being involved in projects of the ADU should write to: Avian Demography Unit, University of Cape Town, Rondebosch 7701, South Africa, tel. (021) 650-2423, e-mail adu@maths.uct.ac.za.

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University of Cape Town, Rondebosch, 7701, South Africa
Tel. (021) 650-2422/1
Fax (021) 650-3434
E-mail: adu@maths.uct.ac.za
www.uct.ac.za/depts/stats/adu

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Author addresses:
S.J. de Beer: c/o Wesvaal Bird Club, PO Box 2413, Potchefstoom, 2520. samdb@iafrica.com
G.M. Lockwood: Delta Park Environmental Centre, PO Box 84701, Greenside, 2034. geoff@birdlife.org.za
J.H.F.A. Raijmakers: 23 Roy Campbell Street, Vanderbijl Park, 1911.
J.M.H. Raijmakers: PO Box 5067, Vanderbijl Park, 1900. raij0124@natref.com
W.A. Scott: Alberante Motors, PO Box 1349, Alberton, 1450. william.scott@bmwdealer.co.za
H.D. Oschadleus: SAFRING, Avian Demography Unit, University of Cape Town, Rondebosch, 7701. dieter@maths.uct.ac.za
L.G. Underhill: SAFRING, Avian Demography Unit, University of Cape Town, Rondebosch, 7701. lgu@maths.uct.ac.za

Editors: L.G. Underhill, T.B. Oatley and H.D. Oschadleus
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Foreword

A new manual for a new millennium!

It is now a quarter-century since John Ledger produced the first *Ringer's Manual* for use in southern Africa. At that time it was not just for the training of new ringers but was also for the guidance of the whole ringing community that had grown rather like Topsy and was in need of regularisation. Since then much has changed in ringing while much has remained the same. Most importantly, the manual has gone out of print and we needed to decide to either reprint it or replace it. John Bunning led the move to completely rewrite the manual and made a valuable contribution to the new text as well as nagging some of the more recalcitrant authors. Terry Oatley provided expert guidance in the early stages of the project.

We still catch birds, ring them, measure and weigh them and release them much as we have done for the first 50 years of bird ringing in southern Africa. However, some things have changed. The most important new development is computerisation. Most ringers are not aware that the real cost of a ring is about three times what the ringer pays for it, the major expense being the cost of administration. Experience around the world has shown that a significant cost reduction can be effected by fully computerising the complete data-collection process. This means that every ringer should enter all his/her ringing, resighting, recapture and recovery data him/herself. In Europe, fully computerising ringing data have also led to a massive increase in the value and utility of the data and to the productivity of the staff of the various ringing administrations.

This new Ringer's Manual is aimed primarily at new ringers and their trainers but will also be of value to existing ringers in helping them to maintain their standards and hopefully in encouraging them to extend their efforts to collect better and more useful data.

This new Ringer's Manual is the result of a collaborative effort by the seven authors aided and encouraged by Leslie Underhill and Dieter Oschadleus and their staff at SAFRING and the Avian Demography Unit. They are all to be congratulated on an excellent piece of work. I hope that this new manual will encourage both new and existing ringers to go out and ring more birds!

Steven Piper
November 2000

Acknowledgements

It is a pleasure to acknowledge the contributions of the following people on some very specific subjects. Dr T.B. Oatley for his contribution of the chapter '*The bird ringer and the law*' and Dr M. Herremans for his contribution of '*The use of plumage features resulting from a partial post-juvenile moult in age determination*' (including Fig. 6.9).

We are also indebted and grateful to Dr Terry Oatley for his time to review, correct and comment on the text. A special word of thanks to him for all his support, words of continuous encouragement and faith in the group of ringers conducting this task.

SASOL sponsored the printing of this Manual.

THIS GUIDE IS DEDICATED TO

The late Frank Douwes, ringer and friend, and

John Bunning, ringer, for their contribution to ringing.

1

Introduction

1.1 INTRODUCTION TO BIRD RINGING

Having decided to embark on training for a bird-ringing permit, it is appropriate that you:

- ❑ Gain insight into the activity.
- ❑ Know how bird ringing originated.
- ❑ Know how the activity is controlled and monitored.
- ❑ Know how South African and international activities are organised.
- ❑ Know what has and is still being achieved.
- ❑ Know what is expected of you both as a trainee and a qualified ringer.
- ❑ Know why you need to undergo a training phase.
- ❑ Know the reasons why we mark or ring birds.

1.2 HISTORY

Man has been marking birds on and off for over 2000 years. The following account (Fisher & Peterson 1964) illustrates this:

> The earliest man known to mark a bird was one Quintus Fabius Pictor. Sometime between 218 and 201 BC, when the second Punic War was on, this Roman officer was sent a swallow, taken from her nestlings, by a besieged garrison. He tied a thread to its leg with knots to indicate the date of his relief attack, and let the bird fly back. In the later Roman days of Pliny (first century AD), a certain knight fond of chariot racing in Rome used to take swallows with him to Volterra, 135 miles away, and releasing them with the winning colours painted on them, no doubt enabling his friends at home to confound the local bookmakers.

During the Middle Ages, falconers fitted metal plates or bands to the legs of their birds. These bands bore the aristocratic seals of their owners and trainers. Falconry originated in the Far East sometime between 2000 BC and 244 AD. (The first indisputable evidence is from Japan.) There was an injection of Arabic techniques into Europe during and after the Crusades (Campbell & Lack 1985: 203), so it may be that ringing of falcons was in existence earlier. The word 'swan mark' dates from the year 1560 and describes the practice of putting a nick on a swan's bill to denote ownership; 'swan-upping' was the custom of annual roundup of swans for marking. Later in the seven

teenth and eighteenth centuries ducks and swans were marked with metal collars by landowners. Later marks were placed on pigeons, both carrier and racing pigeons. There is evidence in Izaak Walton's *The Complete Angler* that by 1653 young salmon had ribbons attached to their tails to establish that after their migration out to sea they returned to their natal streams to breed. The Russians were the first to attempt to mark mammals; Northern Fur Seals were marked on the Pribilof Islands. The ears of young seals were cut off.

The marking of birds for scientific purposes was started in 1899 by a Danish schoolteacher Christian Mortensen. He placed zinc rings on European Starlings. He then changed to aluminium and the rings bore a return address and date. Before ringing, the rings were carried in sand boxes to smooth the cutting edges! Within a year he had accumulated a substantial number of recoveries. The first national ringing scheme was established as the 'Vogelwarte' at Rossitten, on the Baltic coast in Germany in 1903. This scheme was the model followed by many other countries before the First World War: Hungary (1908), Great Britain (1909), Yugoslavia (1910), Holland and Sweden (1911) and Denmark and Norway (1914) (Spencer 1985).

The first ringing of birds in southern Africa, and possibly all of Africa south of the Sahara, was undertaken by the Witwatersrand Bird Club (WBC) in 1948 (Ashton 1979). Members of the WBC scaled the cliffs of Skeerpoort and ringed nestling Cape Vultures. One of these birds was recovered later near Bulawayo in Zimbabwe.

1.3 ORGANISATION

The coordinating body for bird ringing in South Africa is the South African Bird Ringing Unit (SAFRING). SAFRING provides bird-ringing services to ringers throughout southern Africa, and SAFRING rings are routinely used as far north as Malawi. SAFRING is part of the Avian Demography Unit (ADU) in the Department of Statistical Sciences at the University of Cape Town. Because all legal forms of wildlife capture are strictly controlled, the provincial nature/environmental conservation bodies are responsible for the issuing of the required permits to individuals. This should only take place upon the recommendation of SAFRING, who in turn act upon the recommendation of active, recognised ringers in the field. Qualified ringers are issued with an 'authority card' by SAFRING, which states the ringing skills that they have, and which authorises them to use SAFRING rings and equipment. The authority cards are also useful in establishing *bona fides* with landowners, the public and occasionally the police.

In the global scene, SAFRING is one of many national ringing schemes which exchange ringing, recovery and recapture information on a regular basis. Much of this information is generated by a loose collection of people known as bird ringers.

SAFRING has several important functions:

- Coordinating the bird-ringing effort in southern Africa.
- Collating ringing, recapture and recovery data when submitted by various sources.
- Supplying, at minimum cost, bird-ringing requirements such as nets, rings and other specialised equipment.
- Advising ringers on methods and means when targeting species.
- Acting as a clearing house for recapture and recovery data to and from foreign ringing schemes.

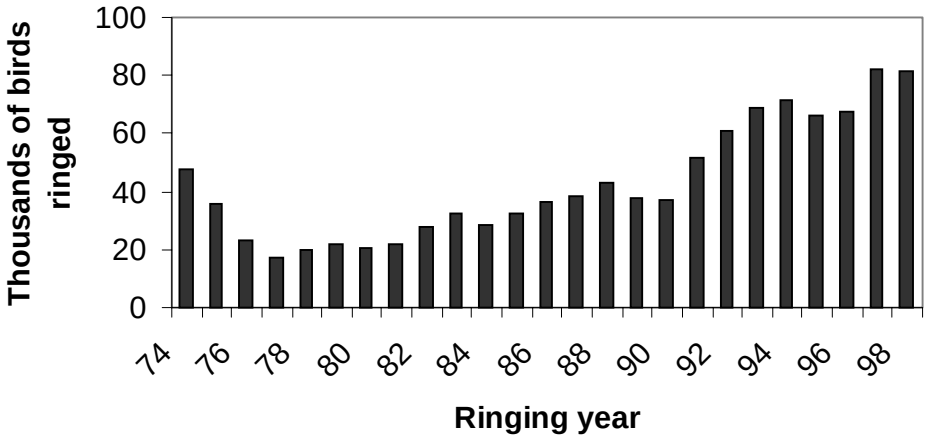


Fig.1.1. Number of birds ringed per ringing year with South African rings from 1974/75 to 1998/99.

- Through *Safring News*, provide a regular medium for the publication of results, information, views, techniques, achievements and other relevant information useful to ringers.
- Coordinate colour ringing and resighting data.

1.4 ACHIEVEMENTS

Ornithology would still be in the Dark Ages were it not for bird ringing or marking! Bird ringing has been described as the research tool that produced the most important results in ornithology during the 20th century. Much of our insight into bird movements and migration, and our knowledge of population dynamics, exists because individual birds have been uniquely marked and subsequently found either at the place of original capture or at another location. It is only by making a bird individually identifiable that we can learn about that individual's movement, longevity and social associations.

In this way aspects of the life histories of a large number of bird species have gradually been unravelled, giving new understanding of the movement of birds as well as raising a whole new set of questions relating to causes and factors contributing to population movement, dynamics and behaviour.

At the start of the 21st century, bird ringing remains the most cost-effective method of studying many aspects of the biology of most common bird species.

1.5 CHALLENGES FACING THE BIRD-RINGING COMMUNITY

Bird ringing in southern Africa has had its ups and downs. Annual totals grew to reach 70 000 birds in the early 1970s. A population crash in bird ringers in the mid-1970s reduced the annual total to around 17 000 towards the end of that decade (Fig. 1.1). Subsequently, there has been steady growth and, by the late 1990s, the annual total was hovering around 70 000 once again. This is not to say that more is necessarily better, but it is rather an indication of levels of activity.

Bird ringers consist of three groups of people: individual ornithologists or researchers, corporate ringers (e.g. Marine and Coastal Management) and amateur ornithologists. The first two groups are mainly academics and researchers based at universities, museums, various government departments and institutes, and environmental NGOs. The third group, forming the bulk of bird ringers, contribute up to 80% of the regional ringing effort and are drawn from all walks of life. These are generally members of BirdLife South Africa who have progressed from birdwatching to bird ringing as their original interest and love for birds has expanded. The groups are not mutually exclusive; many amateur ringers work closely with professional ornithologists and are gradually becoming involved in their projects. Research benefits, from the use of willing and experienced assistants, and the scale of the research projects can be increased. Ringers benefit by having their insights of research broadened, and from a sense that they are contributing their time and skills to a worthwhile project. Such cooperative ventures include projects on Redbilled Quelea, European Swallow, Redbilled Oxpecker, Bald Ibis and African Black Oystercatcher. These ventures have proven to be successful and cost effective and will probably expand in future. Likewise, professional ornithologists can guide amateur bird ringers into independent ringing projects of their own, which will yield valuable research results. A list of research projects involving bird ringing has been produced by the ADU (Underhill *et al*. 1995).

The challenges facing the bird-ringing community are many. Some of these are:

- ❑ Recruitment of new ringers.
- ❑ Effective training of new ringers.
- ❑ Retention of existing funding and sourcing of new funding for:
  - ✧ Administration costs of SAFRING.
  - ✧ Financial support of existing ringers, notably trainers.
  - ✧ Assisting newly qualified ringers with start-up costs.
- ❑ Expansion of ringers into areas not covered at present.
- ❑ Resumption of the trapping and ringing of waterbirds. Most waterbird ringing was done prior to the mid-1970s, and it is likely that patterns of movement of waterbirds have changed since then.
- ❑ Ongoing computerisation of ringing administration, from ringer to SAFRING and vice versa, cutting down on administration time and related costs.
- ❑ Recruitment and involvement of members of formerly disadvantaged communities. Bird ringing is a powerful tool which can assist in establishing an appreciation for birds and the environment in general. Involvement in bird ringing in their school days has led many youngsters into a career in biology and conservation.
- ❑ Liaison with the media, expansion of public awareness of bird ringing, improving the probability that ring recoveries and sightings of colour-marked birds are reported.

1.6 PUBLIC RELATIONS

Bird ringing can be a controversial aspect of ornithology and is opposed by some members of the public, to the extent that capture equipment has occasionally been wilfully damaged. As bird ringers, it is in our interest to correct misconceptions regarding this activity among critics and the public at large. By using the guidelines listed below, you will find it easier to deal with both critical and curious members of the public. Always

be willing and able to demonstrate and explain what you are doing. As a bird ringer, always operate to the highest possible standards that you can attain, and continually seek to improve your knowledge and your techniques.

1.7 REQUIREMENTS FOR BIRD RINGERS

An aspirant bird ringer's ability to operate independently needs to be assessed by the ringers responsible for the candidate's training, who will ultimately recommend the trainee for an AA-permit. To this end, essential areas of proficiency have been identified as being the minimum standards to be achieved by the trainee.

- ❑ A ringer must be competent to operate the equipment used to capture birds in a safe way. This includes the planning, siting, handling and monitoring of nets and traps in different situations.
- ❑ A ringer must be able to capture and handle birds and store them, and fit rings to wild birds, without causing undue stress or injury to the birds.
- ❑ A ringer must have a high level of competence in bird identification of the birds in the hand. A ringer shall not normally ring any bird that cannot be positively identified.
- ❑ A ringer must be able to undertake accurate, repeatable standard anatomical measurements.
- ❑ A ringer must be able to record information accurately, understand and conform to the administrative procedures of SAFRING, submit schedules in good time and store data in the long term.

Permits to ring birds should be issued on the recommendation of SAFRING, which in turn will act on the advice of experienced ringers.

The development of the above-mentioned areas of proficiency and competency is partly linked to the numbers of birds and species processed. However, many of the minor 'crises' an independent ringer has to be able to handle occur rather rarely, so it can take a long time before you are fully competent to operate solo. Your trainer will inform you of the requirements in force in the area in which you are training.

While the preceding standards are very important, the ringing trainer will also assess the trainee's feeling or passion for birds entrusted to his care as well as the trainee's attitude to bird ringing. Should the trainer be of the opinion that a trainee does not have an acceptable attitude towards birds and bird ringing, training can be discontinued if the trainee cannot respond to remedial coaching and advice.

1.8 ETHICS OF BIRD RINGING

- ❑ The well-being of any bird caught and handled for ringing is the paramount consideration.
- ❑ A ringer may not operate more equipment than he/she can properly manage.
- ❑ No ringer may allow unqualified persons to use his/her equipment to capture and handle birds, or fit rings, except under close supervision.
- ❑ No capture of birds should be attempted under conditions that could result in birds becoming severely stressed, subject to potential injury or death, or result in birds

abandoning occupied nests.

- ❑ All traps and mistnets should be carefully inspected every 20 minutes (5–10 minutes during hot weather).
- ❑ Beware of ringing nestlings at too advanced an age (they may 'explode' from the nest). Be careful in mixed colonies with chicks of different ages.
- ❑ A ringer must operate with the necessary ringing permits, as well as the permission from the landowner on whose land ringing takes place.
- ❑ Careful and accurate records of all birds ringed must be kept.
- ❑ A ringer must complete and submit ringing schedules to SAFRING and reply to official requests for ringing data promptly.
- ❑ A ringer must not bring the technique of bird ringing into disrepute by careless, negligent or inappropriate behaviour.
- ❑ If conditions contrary to the above ethics are observed, these should first be brought to the attention of the ringer in a constructive manner. Failing this, the conditions should be brought to the notice of SAFRING, who will then take the matter further with the ringer and, if necessary, the appropriate permit-issuing authorities.
- ❑ Ringers should be willing to explain the methods and purpose of bird ringing to members of the public when necessary.

1.9 RINGERS AND TRAINEES

The following guidelines will make your relationship with your trainer mutually profitable and cordial.

- ❑ Stay in contact; don't expect your trainer to chase after you.
- ❑ Be punctual, keeping to agreed meeting times.
- ❑ Carry out instructions to the best of your ability.
- ❑ When in doubt or uncertain, seek help.
- ❑ Ask questions and make suggestions. Even if they are not applicable or wrong, they do contribute to the learning process.
- ❑ Treat nets and other equipment with care, because these are expensive items to replace.
- ❑ Do not leave the ringing site before all the equipment has been packed and the paper work done to prevent an unnecessary burden on the trainer and fellow trainees.
- ❑ Remember that the welfare of the birds comes first; there might be occasions in the field when little training can take place because the trainer is fully committed to getting birds ringed and released as rapidly as possible.

1.10 WORKING GROUPS

Catching birds with mistnets is the main emphasis of this manual. Several specialist working groups exist in South Africa and most of them include bird ringing as part of their activities. Examples are the South African Crane Working Group, the Raptor Conservation Group, the Vulture Study Group and the Western Cape Wader Study Group. The Southern African National Foundation for the Conservation of Coastal Birds (SANCCOB) rings mainly cleaned African Penguins and Cape Gannets before their release. The ringing of all these species requires special skills and it is broad SAFRING policy that ringing of these groups of species should be done in collaboration with these groups, where appropriate. Ringers interested in these groups are advised to contact the relevant working groups. There are many other species or groups of species which would benefit from the establishment of a formal interest group; for example, a Barn Swallow Study Group could liaise with the EURING Swallow Project, based in Europe.

1.11 CONCLUSION

A great deal is expected of a bird ringer. The standards are high. For those who accept the challenge, bird ringing is a labour of love. It generates a lot of hard work, frequently in unpleasant conditions. It teaches patience and perseverance. Not least, you will learn to tolerate a mosquito biting you while you complete the delicate task of taking a bird out of a mistnet.

Good luck with your training. Having qualified, you will be one of a lucky few who have stumbled across this most rewarding and fulfilling activity.

SAFRING POLICY ON CENSURE OF RINGERS

When a ringer brings SAFRING or bird ringing into disrepute one or more of the following steps may be taken, depending on the severity of the incident(s):

1. A written letter of warning to the ringer.
2. The withdrawal of the ringer's authority to use SAFRING equipment. SAFRING would cease to issue the ringer with any items from SAFRING (i.e. rings, equipment, Safring News); unused rings and stock would have to be returned to SAFRING.
3. A letter to the relevant provincial Nature Conservation department, requesting that the ringing permit issued to the ringer be revoked. A copy of the letter would be sent to all the other provincial Nature Conservation departments.

The decision to censure a ringer will be taken by the Executive Committee of SAFRING, i.e. the Chairman of the Steering Committee, the Director of the Avian Demography Unit and the Ringing Coordinator.

The decision, and the relevant motivation, would be submitted to the Steering Committee as rapidly as possible for confirmation.

2

Catching birds

2.1 INTRODUCTION

Many methods of bird capture have evolved over the centuries and we have the benefit of that accumulated experience at our disposal (see Bub 1991 for an extensive review of trapping methods). The more common methods will be briefly mentioned along with typical species captured. Mistnetting, and some other methods, will then be discussed in greater detail, providing more detailed descriptions of the equipment and its deployment along with some hints on how to obtain the best results for you and the birds. Underhill (1994) summarises capture techniques published in *Safring News* from 1972 to 1993.

2.2 METHODS OF CAPTURE AND TYPICAL SPECIES TARGETED

2.2.1 Mistnets

These include a variety of nets which differ in length, height, mesh size and strand thickness. They are normally deployed vertically to interrupt the flight of a bird, thereby capturing and restraining it in a pocket created by the net. Mistnets are normally used on land and can be used for a large number of birds ranging from sunbirds to ducks. While larger birds have been captured with mistnets, they are the exception.

2.2.2 Walk-in traps

These traps work well when trying to catch ground-feeding birds in large numbers. They work on the general principle of allowing or guiding birds into the trap, while preventing them from escaping. There are many variations of this type of trap and it can be used for a large range of birds, from seed-eaters to ducks.

2.2.3 Drop traps

As with walk-in traps, these are used mainly to catch ground-feeding-birds and can range from a tin to a net rigged with a trigger which can be operated by hand or by an automatic device fitted to the trap. As with the walk-in trap, this type of trap can be used for a wide range of birds.

2.2.4 Cannon nets

Most often used for trapping shorebirds, the cannon net can also be used on concentrations of other species as with the walk-in and drop traps. Large birds, such as vultures, can also be trapped by using this device.

2.2.5 Zap net

This device works on the same principle as the cannon net, but is propelled by rubber bands instead of an explosive charge.

2.2.6 Bal-chatri

This device consists of a double cage covered in fine nooses containing live bait or a lure. The bal-chatri was originally developed in India and the Middle East for the purpose of capturing birds for training in falconry. The bal-chatri is a portable trap and is responsible for the vast majority of captures of free-flying raptors, and a few other species, that will respond to the bait and become ensnared in the nooses. It is used with great success to trap perched raptors along roadsides, but is unsuccessful for raptors on the wing for reasons that are not understood. Specific training is required before this method is used, and the ringer must have a 'bal-chatri endorsement' on their SAFRING authority card before they may ring raptors using this method.

2.2.7 Clap traps

The clap trap consists of two halves which, when triggered, close in on each other, trapping the bird between them. The clap trap is deployed as a perch in an area or over an expanse of water. Typical target species include kingfishers and shrikes.

2.2.8 Torch trapping

This method is used to capture nocturnal species, e.g. nightjars, dikkops and plovers, and is carried out with the help of a strong torch or spotlight. A handnet or similar device is normally used to confine the bird at the moment of capture.

2.2.9 Nestling ringing

Ringing nestlings is often the most efficient method of ringing many species, especially colonial waterbirds, such as gulls, terns, egrets and herons, and some vulture species. Nestlings may also be ringed in the individual nests of non-colonial species. The ringing of nestlings allows birds to be aged exactly when they are recovered and can also provide accurate data on many important aspects including breeding success, parentage, lineage, natal dispersal and site fidelity provided the site is properly monitored on an ongoing basis.

These are some of the most commonly used catching methods, both locally and world-wide. Most bird ringers learn to catch their birds in mistnets. It is a good idea to

attempt to become proficient at several other techniques as well. This will provide you with a greater measure of both success and enjoyment. A safe catching technique has been devised for most species. If you want to study a particular species, and mistnets are not appropriate, discuss your study species with the Ringing Coordinator and other experienced ringers. There are resource books at SAFRING which can provide guidance in most situations. Do not experiment with new ideas until the tried-and-tested ones are exhausted.

2.3 MISTNETTING

2.3.1 Mistnet sizes

Appendix 1 shows different types of nets, the habitat they can be used in, and the species they can be expected to catch. Those marked with an asterisk (*) are currently not readily available from SAFRING, but some can be obtained at an increased cost. Nets may either be tethered or untethered. Tethering means that small knots tie the net at intervals along the top and bottom shelf-strand. This prevents bunching of the mesh in windy conditions. Before ordering nets, seek the advice of the Ringing Coordinator or the ringers responsible for your training.

Net quality varies considerably between manufacturers. Where a RETE 12 m × 2.4 m net is popular for being durable, strong and having deep pockets at relatively low cost, it is also criticised for being too visible and too stretchy. The same strength and durability, without the stretch, is available in North Ronaldsay (NR) nets, but at more than twice the price of the RETE net.

Yamada and Bleitz nets have been used over a long period in southern Africa; Spydertech nets have been available only over the last few years. In the commonly used sizes, a finer mesh is used, reducing visibility at the expense of a more fragile net. While they do not feature the deep pockets of the heavier nets, they have proved popular and effective.

2.3.2 Erecting nets

Mistnets are erected vertically singly or in a line. This is done by opening the net on a pole to deploy the full height of the net. This can be done just off the ground or 10 m up. The pole system you use can be vital in operating efficiently with a minimum amount of time spent erecting the nets or in removing birds.

In southern Africa there are nearly as many pole systems as there are bird ringers, ranging from bamboo poles to leftovers from scrapped army tents. Anchoring methods demonstrate as many variations; some are much more successful than others.

2.3.3 How a mistnet works

The mistnet is deployed in an area in which the target species occurs. The ringer sets the net so that it is not readily visible to the bird, against a dark background or in the shade. The net traps the bird in flight. A mistnet has considerable ‘give’, and the bird is quite gently decelerated to a stop, drops into the pocket created by the shelf-strings of the net and gets entangled. Most individual birds of most species lie quite still in the net soon after being caught. Sometimes, the bird sees the net shortly before contact, stops flying and is carried into the net by its momentum. This gives the appearance of flopping into the net. In some cases, notably among weavers and bishops, after one bird is captured, the rest of the flock fly around to investigate the situation and several more get caught. In other species, such as babblers and Terrestrial Bulbuls, the net is attacked fiercely and vocally in an attempt to free the trapped bird, and more get caught in the process.

2.3.4 Deployment of nets

2.3.4.1 Target species

The abundance of target species and the opportunities to catch them varies a great deal from place to place, even over short distances. Success or failure in mistnetting depends on your ability to identify this and plan the deployment of your nets accordingly.

The behaviour of species varies enormously, and you need to identify the opportunities this offers in terms of catching your target species. These behaviours include roosting, breeding, feeding, watering, habitual flight paths, etc. Having decided which species you wish to trap, you can then go about selecting the site, time and equipment needed to get the job done.

2.3.4.2 Timing

For the majority of species, the best times for mistnetting are either at dawn and dusk, occasionally both. This is because nets tend to be least visible and most likely to be effective. Also, birds tend to move between roosting or feeding areas at these times. Generally speaking, the hours immediately after sunrise are the period of greatest flight activity, especially in summer. Another factor that comes in to play favouring the early morning is that this is the time of day when there is the least wind. Yet other species are caught throughout the day; and others are best caught at night. Having observed and studied the behaviour of your target species, you will rapidly identify the best period during which to set your nets.

Seasonal migrations also play a major role in the trapping of certain species; obviously it is nonsensical to target the summer-visiting migrants during the winter months.

2.3.4.3 Frequency

A ringing site should be trapped on a regular basis to give meaningful results over a period of time. This can vary from weekly to three-monthly or even annual visits to a site.

A ringer should be wary of trapping at a site too often because this could cause the population or parts of it to move away. Birds quickly learn the location of mistnets; if you leave nets at the same place for a few days, the birds local to an area fly round or over them as if they were brick walls. While no hard-and-fast rules exist for how frequently nets can be set up at the same place, a useful rule is once a week. Trapping near a breeding colony, for example of weavers, requires special sensitivity; if it needs to be done at all, it should take place for short periods only, and should be stopped immediately if there is any indication that desertion of nests is taking place.

2.3.4.4 Terrain

The site at which you attempt to trap your target birds should give you as many advantages as possible. It should also avoid as many risks as possible, to yourself as ringer, to the birds and to your equipment. Local conditions should be carefully considered and identified. You need to plan your activities, taking into account the possibility of unwelcome moving objects, such as livestock, game animals, vehicles and even boats destroying nets (or threatening the ringer). Predators such as mongooses and bird-eating raptors may visit your nets and injure or even kill birds. Static hazards include cliffs, sinkholes, dongas and fences. In intertidal habitats, the rising tide may pose problems. In areas prone to thunderstorms, both lightning near hill tops and flash floods in dry riverbeds are hazards. The dry winter season in much of the interior of southern Africa poses the problem of veld fires and you should be constantly aware of this possibility. Know the likely directions from which a fire might approach and monitor these areas carefully for the earliest possible signs of danger.

At some sites, vegetation needs to be trimmed to prevent entanglement of your nets; this should be done sensitively with pruning shears to avoid unsightly damage to vegetation. Reeds, rushes and other offending low vegetation below the net can be removed or flattened with a slasher, panga or pole. In reedbeds, try to make a bend at the entrance of the 'lane' for your nets, so that it is less visibly intrusive. Having trimmed branches and other vegetation, clear the debris away from the net so that it does not become an obstacle at a later stage, and so that it does not snag onto the net.

When putting a net across a river, check that it will not droop into the river with the weight of captured birds.

If small predators such as mongooses are present at the ringing site, the nets should be set in such a way that the bottom shelf is well clear of the ground. Avoid placing nets so far apart that checking them all becomes difficult. On the other hand, if they are very close together, this can reduce the total catch.

2.3.4.5 Visibility

Avoid erecting your nets in places where every bird in the district can see them. In short, camouflage, conceal, hide or do whatever it takes to make the nets less visible. Nets should be sited against an appropriate background whenever possible. This will prevent the nets being outlined against the sky, water or field, and sticking out like a sore thumb to the bird's keen eyesight. Nets in the shade, usually of vegetation, generally catch more birds than nets in the sun. The best background for mistnets is mostly dark-green vegetation. Bear in mind that the view of a bird differs from what you see from the ground. What may appear to be nets with a perfect background from your viewpoint may be sharply outlined from the bird's perspective.

2.3.4.6 Weather

A bird ringer soon takes a keen interest in weather forecasts. Two of the weather conditions which adversely affect mistnetting are wind and rain. Extreme heat and extreme cold are also hazards. Do not initiate a ringing expedition in adverse conditions. If the weather turns bad, you have a choice between dismantling the nets, and furling them.

This means that you move the loops at the ends of the shelf-strings together on each pole; this reduces the catching area of the net to a minimum, and makes the net highly visible. It is a good idea to use string to tie the netting together at intervals along its length; sometimes it is more time-consuming to untangle a furled net than it is to take it down and re-erect it later.

Wind, depending on strength, makes nets more visible because they wave and billow. It causes bunching of the mesh, stretches the shelf-strands and can even, in extreme conditions, result in injury and even death to birds trapped in the net. In addition to this, birds striking the net on the downwind side bounce off because the nets billow out and do not form a pocket. On the upwind side, they fly out of the net because the pocket is blown open and the bird can escape. Particularly strong winds can damage your nets; the tension on the shelf-strings is formidable, and they snap, and the delicate mistnet material can tear. In general, if the day dawns windy, ringing is a waste of time; go back to bed! If wind becomes strong while you are ringing, take your nets down, rather than furling them.

Ringing in the rain is even worse than ringing in the wind. The worst-case scenario is that a wet bird in a mistnet is at severe risk from dying of exposure. The reason is that some birds are trapped belly-up in the pocket, exposing the soft ventral feathers that do not disperse water. In this way water soaks through to the skin of the bird causing a rapid loss of body heat. **Never use mistnets in rain**. If it starts to rain while you are ringing, furl your nets as rapidly as possible.

Extreme heat is also a potential cause of exhaustion and death among trapped birds. Birds which remain in the net for a long period of time on a hot day are likely to succumb to heat exhaustion. This applies to all species, but more so to the smaller species such as waxbills and white-eyes; at extremely high temperatures, waxbills can perish within as little as five minutes if netted in direct sunlight. In general, birds do not move about very much when it is so hot, and few birds get trapped. If it is so hot that the few birds you catch start looking heat-stressed (panting), furl your nets and stop ringing.

In sub-zero conditions, birds lose heat rapidly in mistnets, largely because they are stationary and their feathers are not in the best position to maximise insulation. Trapped birds should be extracted from the net, and stored in a bird bag in a draught-free environment at an appropriate temperature (see Chapter 3).

2.3.4.7 Monitoring

Nets should never be left unattended for even a short period of time. The ideal setup would allow you to view all your nets from the ringing table and be able to see any birds trapped.

If at any stage you catch more birds than you and your assistants can deal with in an hour, be prepared to furl your nets until you have processed the backlog, and then reopen the nets.

In any event, you should inspect every metre of every net at regular intervals as a matter of policy. This will ensure that you do not miss smaller birds that are not visible at a distance; birds in the bottom pocket of the net can easily be overlooked if the weight of the bird pulls the net down into any vegetation below. Frequent checking also simplifies extraction because the longer a bird remains in the net, the more entangled it tends to become. A good guideline is to do a 'net round' every 15 to 20 minutes,

bearing in mind that you also have to process the birds you have caught between net rounds. The frequency of net visits should be increased in cold weather, in hot weather and in mist, fog and the lightest of drizzles. If drizzle shows any signs of turning to rain, all nets should be furled immediately.

When inspecting nets, approach them quietly from one end so as not to disturb any birds in the immediate area. Any bird trapped in a net can usually be seen looking at the net end on while standing next to the net pole (but not always if you approach the net at right angles). As a general rule, when extracting birds from a mistnet or a line of mistnets, start from one end and work silently and steadily towards the opposite end. This will leave the remaining part of the nets unobstructed for further captures. Unnecessary noise should be avoided when at the nets, because this increases the disturbance created by your presence and the amount of time before the site returns to a natural, undisturbed state. Running and shouting are generally unacceptable human behaviours while mistnetting. Try to keep both panic and enthusiasm ('Hey, everyone, come and look what I've got here') under control.

All rules need to broken sometimes. If you have several nets in place, it is frequently a good idea to start the net round by looking critically at all of them. Identify any birds which have been caught badly (see Chapter 3). If there are any, take them out of the nets first. If there is a net that is hanging heavy with lots of birds, then give this net a priority clearance. If, as usually happens, there are no problems, start quietly at the far end of the collection of nets, and work steadily back towards the ringing table.

The access to your sites should be as direct and easy as possible, as this will shorten the time taken to do each net round as well as enabling you to react to any emergency as quickly as possible.

Look out for predators (especially small raptors, mongooses, domestic cats and coucals) that may attempt to kill birds caught in your nets.

2.3.4.8 Net formations

By deploying your nets in certain patterns or formations you will enhance your capture rates in many cases. Formations can be placed in two categories.

The 'L' and 'V' shaped formations allow you to cover different flight paths into a netting site. If you slowly approach the nets from the open end of the formation, birds between you and the nets will be flushed towards them, increasing the chances of capture. This method will also increase the chances of capturing birds that fly parallel along the net, catching them in a net running in a different direction.

Random formations are very often needed in bushy terrain, where you cannot deploy nets in lines. By making use of different net lengths, you can deploy your nets around a series of obstacles without interrupting the net line. Net formations or trains need fewer net poles and pegs than single nets, but are generally more time-consuming to erect than are single nets.

2.3.5 Net maintenance

Nets are prone to deteriorate over a period of time. The most common problem is broken mesh strands caused by any number of incidents, including thorn trees, fast-flying geese, cattle, game and barbed-wire fences. Well-meaning members of the public may attempt to free birds in an unattended net by cutting them free with a pair of scissors or knife. As a responsible ringer, you need to maintain your mistnets so that they trap birds efficiently. Birds that get entangled in a damaged section of net are usually more difficult to extract.

Other problems include shelf-strands breaking, tethering strands becoming unknotted and loops breaking. When you notice a breakage, take immediate steps to rectify it. Should you not do so, you may find yourself trying to repair a net in the pitch darkness of early morning while the bird world comes alive around you.

Appendix 2 attempts to illustrate a net-repair method that restores the mesh construction. Take the time to practise it and lay in a huge reserve of patience, tranquil surroundings and some good music before you start with your repairs.

2.4 WALK-IN TRAPS

These consist of a variety of traps designed to trap a wide range of birds. Through baiting or habit, the bird is guided into a position where it is confined and unable to escape. In many cases the confinement is psychological because the bird cannot retrace its access route. Walk-in traps are susceptible to predators, especially when used in the same place for days and weeks at a time

Many of the guidelines considered under mistnetting apply to most other trapping methods as well. In the case of walk-in traps there are additional considerations, i.e.

- ❑ Traps should only be deployed if and when a ringer can patrol the traps regularly.
- ❑ Unless traps are cleared at short intervals, as for mistnets, traps should be provided with suitable food and water for the target species.
- ❑ Where it is deemed necessary to empty traps after extended periods, the traps should be set in an area safe from human interference or predators. The holding section of the trap should also be inaccessible to predators.

2.5 DROP TRAPS

This basic type of trap has been used through the ages for hunting birds. Drop traps are normally set up at a feeding site, where a concentration of birds occur. To ensure that a concentration of birds occurs at the planned trapping site, a ringer can create a feeding site for a target species. Whenever possible, the site should be free from disturbance. The trap can consist of almost any material that will create a container when dropped over a bird. This can range from an oil tin to a net mounted on a frame, depending on species, target numbers and the sophistication or ingenuity of the trapper.

Triggers for the drop trap can be either manual (i.e. hand-line) or automatic (i.e. target activated). The hand-line method is by far the simplest and most reliable, although it does require that the trapper remain in the area to monitor and activate the trap. Automatic triggers are normally pressure activated (i.e. target perching on trigger) but often fail when the trigger is not sensitive enough or when birds are only part way into the trap. Most of the guidelines given in the preceding methods apply to the use of drop traps.

3

The handling and storage of birds

3.1 INTRODUCTION

A bird ringer's primary concern should always be for the safety and well-being of the bird at each stage of the ringing process. This chapter focuses on the best techniques for handling, keeping and releasing captured birds. Birds are usually 'stored' for a period, between the time in which they are extracted from the net, and the time when they are transported to the ringing station, processed and released. The objective is to keep them safe with as little discomfort and stress as possible. The objective is to minimise the period between capture and release.

3.2 EXTRACTION TECHNIQUES

Extracting a bird from a net is probably the most difficult part of the whole netting and ringing operation. To extract a bird from a net is a skill that most people take a good while to acquire; there are very few 'natural' extractors. As with many things, but especially with bird extraction from a mistnet, experience and practice are the best learning methods. Extraction cannot be learnt from a book. When first starting as a trainee bird ringer, one often feels as if one will never master the technique of extracting birds unharmed from a net. Somehow each bird that is caught is different and requires a technique on its own. Suddenly, one day, you start to find that the birds are coming out more easily. For this reason prospective bird ringers have to undergo an extended training period under the guidance of an experienced ringer. Not everyone is able to master the technique; extracting birds safely from mistnets requires some testing character traits: in particular, patience, persistence and compassion. There are lots of people who simply do not have the patience, persistence and fine motor control to work out how the bird has entered the net and disentangle it from the net strand by strand, nor have the compassion to realise that they are dealing with a live animal that must be treated delicately yet firmly and come out of the net unharmed.

Where aggressive birds, e.g. weavers, are close to other passerines, e.g. a waxbill, remove one of the birds immediately.

3.2.1 Guidelines for extracting birds from a net

- ❑ Determine from which side the bird entered the net. This can be far harder than it sounds.

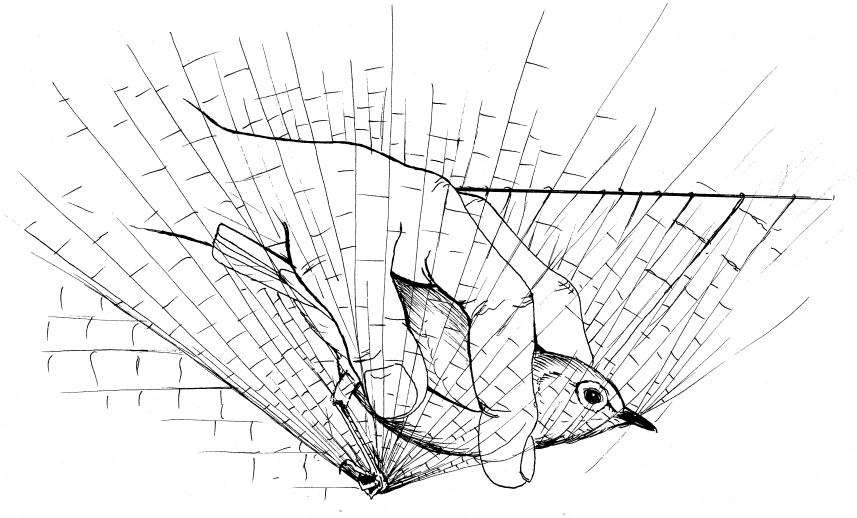


Fig. 3.1. Holding the bird trapped in a mistnet.

- ❑ Remove the larger birds first out of the net when both small and large birds have been netted simultaneously. Larger birds tend not to get tangled badly and often run down the pockets of the net when approached and are prone to escaping. They might even cause injury to smaller birds.
- ❑ Check the bottom shelf thoroughly; birds caught in this shelf can be obscured by vegetation.
- ❑ The birds in the bottom shelf should usually be extracted first; they are the most vulnerable to predators such as mongooses and ants, and are liable to become damp if there is dew on the vegetation under the net.
- ❑ When removing one bird from the net, always make sure not to pull it in such a way that other birds in the net are subjected to tension on the net.
- ❑ When birds are trapped high up in the net, lower it before attempting extraction. This will prevent you working with your arms above your head; this quickly becomes tiring, and you cease to work efficiently.

3.2.2 Extracting a bird from a net

Birds get caught in mistnets in a huge variety of ways, and there is no single universal method that can be followed for every bird. There are however some general principles that help to make the task easier.

- ❑ The steps in extracting a bird from a net should be the reverse of those involved in it going into the net.
- ❑ The first step is to determine from which side it entered the net.
- ❑ Birds which are lying on their backs or sides and which are not too badly entangled can be taken straight away into the standard ringer's hold (Fig. 3.1). This prevents

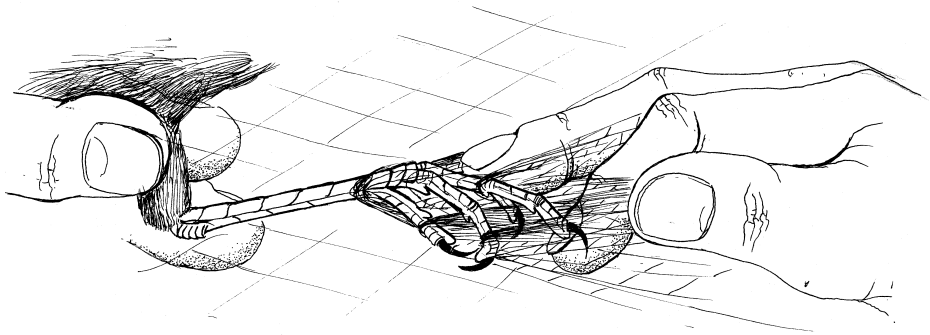


Fig. 3.2. Extracting the feet from the netting.

the bird from becoming further entangled because birds that are in the net in this way are normally not too badly entangled.

- ❑ Depending on the situation the bird is in, one can usually start by removing the net from the one leg; hold the tarsus between thumb and forefinger just above the foot and remove the net by stroking or gently pulling it towards the toes (Fig. 3.2). This often frees the foot and toes from the net.
- ❑ If the net is looped around the toes, always remove the net from the rear toe first by picking on the net strands.
- ❑ Next, free the other toes of the first foot one by one.
- ❑ Now remove the net from the wing on the same side as the first foot, then the head, and then the other wing.
- ❑ Usually by this time the bird has relaxed its feet and the other foot has released the net or is easily removed from the net.
- ❑ This technique is nearly like rolling the bird out of the net.

Occasionally birds get entangled to a much greater extent than this; the golden rules are **DO NOT PANIC** and **FIND THE BARE BELLY FIRST** (Fig. 3.3). When you have found the bare belly, you reassess the situation and decide on the easiest way to extract the bird. From here, for most birds, the following steps constitute a general method to extract the bird.

- ❑ Get a firm but gentle grip on one tarsus and remove the net strands from the foot and toes; when the foot is free, hold it to prevent it from gripping the net again. (If mosquitoes bite when you reach this stage, let them bite.)
- ❑ When the second leg is freed, change the grip so that the ankles are held between the thumb and middle finger with the forefinger between the ankles (never hold a bird by the tarsi as this can cause serious injury).
- ❑ Lift the bird out of the pocket and pull it carefully away from the net.
- ❑ Doing this usually has the effect of removing much of the net from the wings and body.
- ❑ Now first remove the net from the tail and back and then the one wing.
- ❑ After this, free the other wing and then the head (Fig. 3.4).

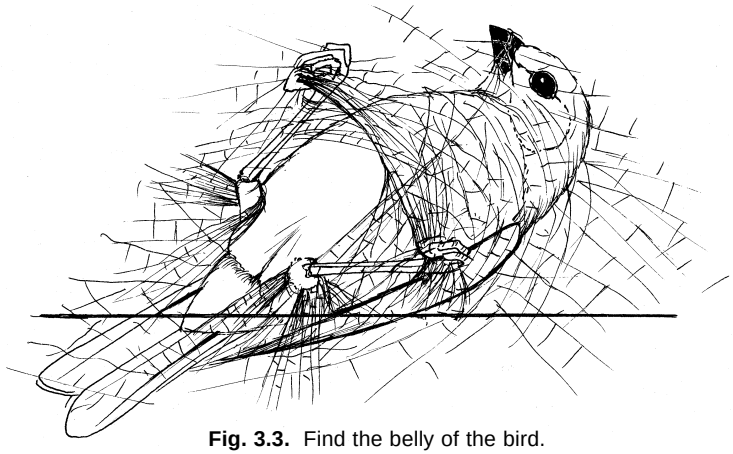


Fig. 3.3. Find the belly of the bird.

More difficult situations arise when birds are double-pocketed or twisted in the net. These problems are worst on windy days. Another particularly bad case can result when a bird flies into the net right next to the pocket-spacer string and ‘wraps’ itself around the string a few times. In situations like these it is critical to remove the net ‘layer by layer’. In the case of twisting, the twist should be undone in the sequence in which it occurred. Some of these cases occasionally perplex and create a lot of perspiration even for the most experienced ringer. Most cases, however, are quite easily overcome as experience is gained.

There are still two more areas that can cause considerable difficulties in extracting a bird from a net, the one being the carpal joint and the other being a case of a ‘tongued’ bird.

When birds are caught in a mistnet, the mesh occasionally goes over the closed wing and thus over the carpal joint. Because the wing is one of the most important parts of the body for a bird, the net strands have to be removed without damaging the wing. With small birds one can simply open the wing gently and the net will slip off by itself or it will slacken enough so that it can be lifted off. When the net is caught more tightly, push a finger or thumbnail under the net strand on the underside of the wing and lift it over the joint. When doing this, be careful not to damage the feathers, and try to lift the net over the carpal joint from the body’s side towards the wing tip. For birds that are very tightly ‘carpalled’, this procedure cannot be followed as it will damage both the feathers and the carpal joint. Here it is necessary to pull the rest of the wing gently through the mesh square. This is done by carefully bending and pulling the primaries through the mesh square that has trapped the carpal joint. This leaves one strand of net around the base of the wing that slips off the wing remarkably easily. Although this procedure does cause the feathers to look rather ruffled, the bird sorts itself out by preening the wing as soon as it is released.

Occasionally birds get ‘tongued’ in the process of mistnetting. Although this does not happen frequently, it seems that the weavers, bishops and thrushes are more prone to this than other families. The reason for birds getting ‘tongued’ is that they have two backward-facing barbs on the upper part of the tongue; the net strands can get caught

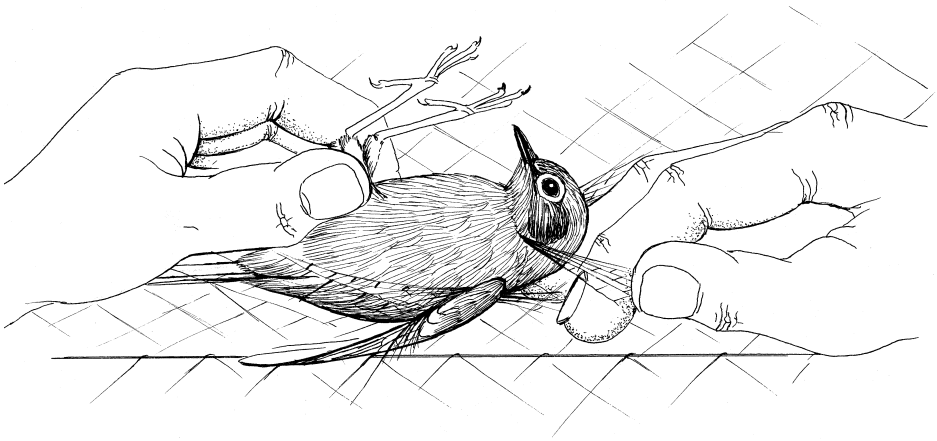


Fig. 3.4. Extracting the head.

behind either one or both of these barbs. If this situation occurs, do not pull the bird away from the net as this puts tension on the net and thus causes injury to the bird's tongue. The net strands that are caught must be lifted backward over the barb. This operation is easier if a small tool such as a 'quick unpick', a crochet hook or even a small twig, is used to lift the strand over the barbs. Every now and again a birds gets really badly 'tongued', and the easiest thing to do is to cut one strand of the net and free the tongue.

Some species bite, scratch or claw the extractor. Getting the bird as quickly as possible into the ringer's grip reduces the number of injuries to the ringer's hands. It does require a rather special kind of personality and a high pain threshold to remove a badly caught barbet from the net without losing one's sense of humour. Some individuals of a few species scream blue murder for the whole period you spend taking them out of the net; it is very important that you do not let this rush you and harass you.

Skills in handling all these difficult situations are best learnt from an experienced ringer. At the end of the day, it is the ability to handle most of these mistnet extraction problems routinely that finally helps determine whether a trainee is capable of ringing independently, and is ready to receive a ringing permit. One of the reasons why it takes such a long time to train as a ringer is that the difficult situations arise rather rarely. A trainee should take encouragement that the end of apprenticeship is at hand when the trainer starts leaving all the difficult cases, and especially the 'tongued' weavers, the badly caught barbets and the 'screamers', to the trainee.

3.3 HANDLING BIRDS

It is best to get a good grip on the bird as soon as it has been removed from the net, trap or holding unit in the ringer's hold. Use your non-dominant hand, i.e. if you are right-handed, use your left hand and vice versa.

Fig. 3.5. Ringer's hold.

3.3.1 The ringer's hold

The ringer's hold is a firm but gentle grip on the bird with its wings closed and its back against the palm of the hand with the head between the index and middle finger, with the ring and little finger lightly closed around the lower part of the bird's body (Fig. 3.5). The leg can then be easily held between the thumb and index finger so that the ring can be fitted. In alternative methods the leg can either be held between the thumb and ring finger or between the thumb and middle finger. A ringer needs to be able to transfer a bird from one hand to the other and from one grip to the other. Quality bird ringers are not known for the number of birds they ring but for how they hold and handle birds.

3.3.2 The standard hold

This is the hold that comes naturally to most people. The bird is held with its back towards the palm of your hand and with the four fingers around the body and the thumb across the throat and chest (not illustrated). The thumb and encircled fingers are held in such a way as to prevent the bird from flapping and struggling. With this hold it is not possible to ring the bird safely. It is dangerous for the bird because, to prevent the bird from flapping, pressure on the chest needs to be applied by the thumb. Ringers should never use this way of holding birds, however, natural it might feel.

3.3.3 The reverse hold

It is similar to the standard hold but the bird faces the opposite direction, with the head towards the wrist and the tail protruding between the thumb and index finger and the other fingers across the chest (Fig. 3.6). The reverse hold is not a convenient hold if measurements are to be taken.

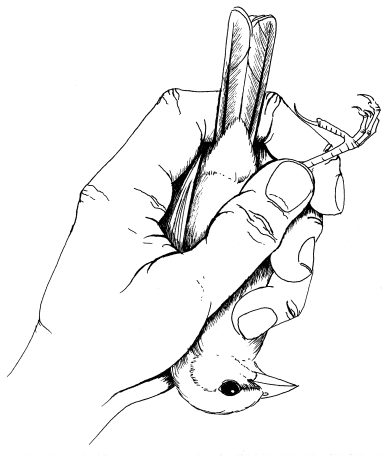


Fig. 3.6. Reverse hold.

3.3.3 General rules for handling birds

- ❑ Hold birds firmly enough to prevent them from struggling but not so tight as to put pressure on the body. If they are held too tight, breathing is restricted and the bird will start gasping. Beginners tend to exert too much pressure on a bird for fear that it might escape.
- ❑ Gasping is the warning sign that the bird's breathing is being restricted either by too much pressure on the windpipe or on the internal air sacs. Trainee ringers should be instructed to observe the breathing behaviour of the bird in the hand. A casualty due to restricted breathing can occur very quickly, but it seldom happens without the warning sign.
- ❑ Avoid pressure on the abdomen in the breeding season as females may be carrying eggs in the oviduct.
- ❑ Some birds tend to struggle in the hand, e.g. the Lesser Honeyguide flicks its wings and pulls its head back; mousebirds often do the same. These birds must not be held too loosely, not only because they can escape, but also because they may hurt themselves in the process. Trainees should only be allowed to handle these peculiar species once they have some experience.
- ❑ Birds too large to hold in one hand should be handled by two ringers, the one holding the bird and the other to put on the ring and take measurements. If you are alone, the bird can be put on its back on your lap with your knees kept together. Cover the bird with a cloth so that only its legs are free.
- ❑ Care should be taken when working with herons, darters, gulls and some other larger birds which lunge with their beaks at the ringer. To prevent injury, cover the bird's head with a hood or a bird bag.
- ❑ Raptors attack with their talons and not with their beaks. Cover the head with a bird bag or a hood to calm the bird down and get a firm hold on both of the legs. These birds should preferably be ringed and measured by two persons; one holds the bird while the other puts on the ring and takes the measurements. Do not put your trust in the story that a stick should be placed in their talons to grip while you handle the bird.
- ❑ When opening the wing for examination, take great care not to place strain on the wing muscles. Do not spread the wing more than is absolutely necessary and do not give any sudden jerks; spread the wings gently as in natural movement. Keep the hands as dry as possible, as perspiring hands may quickly disarrange feathers and make examination more difficult.
- ❑ Avoid prolonged handling.
- ❑ The safest method for passing a bird from one ringer to another is to put it back into the bird bag. Alternatively it might be held by the tibia while the other ringer takes it in the ringer's hold.
- ❑ Occasionally, ringers have fatalities. If at all possible, dead birds should be carefully labelled with date and place, placed in a deep freeze in a plastic bag, and transferred to museums or researchers.

3.4 KEEPING BIRDS AND TYPES OF CONTAINERS

After birds have been removed from traps or nets, they need to be stored or kept in something until they are processed. Containers with birds in them should be placed in a cool spot on hot days and in a warm spot out of the wind on cold days. Birds should be kept for as short a period as possible.

3.4.1 Bird bags

Bird bags are the most widely used device for keeping birds. From the ringer's perspective, they are light, compact, cost-effective and are easily cleaned and maintained. For the birds, they are well ventilated and reduce stress, because they are not aware of humans and other birds in unusually close proximity.

Bird bags should be made of a soft material, such as used for sheets. Bags of different sizes can be made for different-sized birds but a popular size is approximately 250 mm long and 180 mm wide; these can take birds up to the size of doves. The drawstring at the top of the bag should be made of a soft material or string that is long enough to loop around the neck of the closed bag with a simple half hitch. This prevents birds from escaping. These drawstrings are also ideal for hanging the bags when full. Drawstrings can be of different lengths to suit each ringer, depending on the manner in which the bags will be carried, around the arm, around the neck or any other way. This keeps the hands free for extracting other birds.

The rules for using bird bags are almost entirely common sense, and obvious:

- ❑ Do not place bags with birds in shelf-pockets of mistnets because this will put more tension on the net and may also complicate the removal of other birds still in the net.
- ❑ Each bird should be kept alone in a bag; if it ever proves necessary to break this rule, put birds of the same species together in a bag. Individuals of the more aggressive species must always be kept separate.

- Devise a system whereby birds waiting in bags in the queue for ringing are processed in roughly the order in which they were caught. Each bag in the queue should be well spaced from the next. Some ringers use a plank of wood with a series of hooks. Others simply use a round pole; birds are placed at one end on arrival, shifted along systematically and removed for processing from the other end.
- Do not carry too many birds together and avoid mixing large and heavy birds with small ones. While birds are being carried in bags, they should not be swung, or bumped against bushes or other objects.
- Never place bags containing birds on the ground where someone may stand on them.
- Never place bags containing birds on the seat of a chair where they may be sat on.
- Never hang bags containing birds in places where they may be forgotten.
- Never hang bags containing birds over water, not even temporarily.
- Never place bags containing birds on a flat surface such as a table because the birds may start moving and fall from the table with possible injury.
- Hang bags sufficiently far above the ground for them to be out of reach of any possible predators.
- Bags should be turned inside out every time after the bird it contained has been released, to remove droppings and any other debris that may have collected inside it.
- Before opening a bag to process a bird, check its position in the bag. If it has climbed up towards the neck of the bag, gently work it down to the bottom before opening.
- Wash bags regularly.
- Check bags for open seams and frayed material, and repair or trim; if this is neglected the bird may get unnecessarily entangled.

3.4.2 Cages

Cages made of mesh wire or wire bars are not recommended. Wild birds will always attempt to escape from a cage out of which they can see, and may damage their beaks, ceres, heads, feet and claws. Covering the cage with shade-cloth or cloth material may help reduce stress and calm the bird.

3.4.3 Boxes

A holding box is made of wood or other suitable material with a sleeve over the entrance to prevent birds from escaping. A number of small holes of pencil size must be made in the sides and the top of the box to provide ventilation. A carry strap or handle may be fitted to the box for easier handling. Shoulder straps allow both hands to be free. Boxes may be divided into several smaller compartments to prevent overcrowding, and to keep species separate. Such boxes provide a good system for holding birds. Because the boxes are reasonably dark inside, birds remain calm and suffer little stress. The disadvantage of boxes is that they are usually heavy and bulky, and they are usually difficult to keep clean inside. Holding boxes with shoulder straps usually provide the best method of transporting birds from the nets to the ringing table when the nets are placed over water, for example, when catching waders.

3.4.4 Keeps

Keeps are usually enclosures made from a hoop or arch of galvanised wire or aluminium covered by shade-cloth, hessian or mutton cloth. These keeps are handy when catching large numbers of birds such as waders, swallows, swifts and martins. For waders, the hoops are made of stiff galvanised wire or aluminium and are pushed into the ground and covered with shade-cloth. The cloth must be weighed down at the sides, often with sand, so as to make contact with the ground. Sleeves with drawstrings are required at each end from which the birds can be removed.

Another type of keep for smaller birds can be made from three or four stiff galvanised wire or aluminium hoops, 300 mm in diameter. Fix a sleeve of nylon shade-cloth of about one metre in length over this, spacing the hoops equally and sewing them fast onto the shade-cloth. Leave enough cloth at the top so that it can be bound together. To this a piece of strong rope or hook is attached from which the keep can be hung. Leave enough material at the bottom to make a sleeve with a drawstring through which the birds can be placed into or removed from the keep. These keeps have the advantage that they are collapsible, small and light.

3.5 RELEASING BIRDS

When releasing a bird, put it on your open hand, not too high off the ground; let it gather its senses and fly off in its own time. Never throw a bird into the air. With waders and doves place them on the ground where they will walk away and fly off.

Swifts and large birds with short legs and long wings should be held facing the wind to help them take off. Seabirds should be released towards the sea. On shorelines and islands, birds should not be released in a position from which strong winds might blow them out over the sea or lake.

Always release birds well away from mistnets to avoid immediate recapture. If two or more birds of the same species are caught together, possibly a mated pair or family party, release them simultaneously. When you suspect that you have caught part of a family party of adults and their recently fledged young, give the birds you have caught priority in processing, take them back to the place where they were captured and release them there; this ensures that the group re-establishes itself as rapidly as possible.

3.6 HOLDING TIMES

There seems to be no hard-and-fast rule as to the maximum time a bird can be kept before being processed, except that it should be released as quickly as possible. A useful guideline is never to have more birds waiting in the queue to be processed than can be managed in one hour. If it is extremely cold or extremely hot, the total time between capture and release should be even shorter.

There are exceptions to this rule. If birds are caught around dusk (and this usually involves catching birds in large numbers on their way to a roost), those birds which are not processed before it is dark can (and usually should) be kept overnight and released at or near the capture site at first light the following morning. If birds are to be kept overnight, the following precautions need to be borne in mind. Hold the birds in well-separated, well-ventilated bags or in boxes or keeps in which the birds are well spaced.

The holding area needs to be airy but not windy, and access by any form of predator should be impossible. Establish the time of first light, and set your alarm clock.

Use the **'first in, first out'** (FIFO) principle. Birds should be processed in the order in which they were caught or brought to the ringing table. Special care should be taken when one team does the extraction from mistnets and another team does the ringing. There needs to be a system by which the most recently trapped birds are not mixed with the birds trapped earlier. The FIFO rule should be overruled when you have caught:

- ❑ a breeding female
- ❑ a parent possibly feeding young
- ❑ an immature still dependent on its parents
- ❑ one of a family group or breeding pair which may move off
- ❑ a bird that shows any signs of stress, for example because it was difficult to remove from the mistnet
- ❑ a species known to give problems. For example, most species of terns are reluctant to fly off after release if they have been held in a poorly ventilated keep for too long (this appears to be a temperature-related problem). Where there are indications that a species is a problem, inform other ringers by submitting a short note in *Safring News*. If you find a solution to the problem, do likewise. For terns, the secret is to catch them in small numbers, keep them individually in very airy boxes, and process and release them within half an hour.

3.7 TRANSPORTING BIRDS

Birds may not be transported from the place of capture, with the following exceptions:

- ❑ The birds were caught at dusk, and have been kept overnight, in which case they must be returned to the same spot at first light the following morning.
- ❑ Birds are being trapped for research purposes. In this case permits must be obtained from the relevant conservation authorities, and clearance must have been obtained from the animal ethics committee of the institution to which the researcher is attached.

Sometimes ringers are approached to trap and remove birds that are being a nuisance or doing damage. The threat is made that the birds will be destroyed, often illegally, unless removed. Ringers have no authority to do this; they should ask for a few days' grace and seek guidance from the appropriate conservation authority as to the suggested course of action.

3.8 MASS RINGING

Sometimes ringers are called upon to help with large-scale ringing associated with research projects. This may vary from catching a few hundred waders or weavers for a postgraduate student, to catching thousands of swallows or queleas for an internationally coordinated project. Whenever you are part of a team aiming to catch and ring more than a hundred birds in a session, special methods are needed.

In mass-ringing situations, there are two essential components: leadership and teamwork. Someone must have the respect and the authority to take decisions; these qualities are based on experience. The remainder of the team need to be followers, and carry out the tasks delegated to them by the leader to the best of their ability. Remember that it is the welfare of the birds that comes first, not the egos of the team members. The decisions that have to be taken by the leadership include the composition of the team, where the mistnets are to be sited, and the delegation of tasks such as putting up and taking down nets, being an extractor, a ringer, scribe or coffee-maker. In taking these decisions, the leader generally weighs up the skills and abilities of each team member. If a team member feels hard done by, wait until the last bird has been processed, and then discuss the problem with the leader. But issues involving the welfare of the birds should not wait, but be raised with the leader immediately.

Leaders of large ringing teams should hold a post-ringing debriefing session; if possible, this should take place soon after the last birds have been released. The main topic to be discussed is: 'How could we have done the job better?' Leaders should be prepared to listen to and accept the suggestions (and even criticisms) of the team members.

In mass-ringing operations, the objective is usually to get as many birds ringed as possible in order to maximise information about movements and survival. The average overall recovery rate with SAFRING rings is about 1%, but this varies greatly between species. If you ring a thousand birds, you can expect roughly 10 to be recovered subsequently. If you are ringing for recoveries, it is usually not necessary to measure every bird (although it is generally valuable to age and sex them). If measurement data are required, consider taking the full set of observations from a sub-sample of the birds trapped. A sample of a hundred birds taken from the total catch at a session might provide adequate indication of the measurements of the entire population at the time. The statisticians in the Avian Demography Unit, of which SAFRING is part, can provide guidance on sub-sampling. The objective is to minimise the average period between capture and release.

The behaviour of the target species needs to be studied intensively over a period leading up to the first trapping attempt. The best time, place and capture methods need to be carefully considered in order to make a success of the first attempt. Bear in mind that there is often only one opportunity. Having decided the hows, wheres and whens, make sure that the team is of adequate size and that enough of the right equipment is on hand and in good working order. Try to leave nothing to chance.

Nets need to be properly anchored and taut. The setting of every net needs to be carefully checked. A large catch in a single net may drag the net down onto the ground where the birds may be subject to predators, moisture, heat or ants. Each pole must also be anchored on both sides, perpendicular to the net, to prevent an empty net being bowled over when a large flocks flies into it from one side, or a full net from being blown over by the wind.

To handle large catches, nets need to be strong. Do not use thin, flimsy or very stretchy nets in situations in which large catches are possible. The overall weight of the birds may tear the net, or drag it to ground level. The Italian (RETE) and North Ronaldsay nets are the best-suited makes for mass-ringing projects.

Temperature considerations are important. Extremely high temperatures by day and low temperatures by night might lead to fatalities in the nets. Rather restrict the size of the total catch by erecting fewer nets and lose none to temperature. If there is the slightest hint of rain, do not go ahead with mass trapping of the birds.

If it is feasible, consider doing the ringing of most birds at the nets as soon as they are extracted. The sample of birds needed for full data collection should usually be extracted first and transported to the ringing centre for processing by ringers who commence this aspect of the operation immediately. The birds ringed at the net need to released in such a way that they do not fly directly back into the nets. Holding bags need to be carried for non-target species, recaptures of ringed birds and birds of any particular interest (e.g. in unusual plumage). Pliers and rings should preferably be attached to the ringer by strap or string, so that it is not possible to drop them. A useful technique is to put the string of rings in a plastic film or pill container with a hole in one end and a string that goes around the ringer's neck attached to the other end. These containers should be loaded and marked before the ringing session starts and should be used in sequence. If the individual birds need to be aged or sexed, either a scribe is needed, or several ring containers must be used simultaneously, one for each age or sex class.

If birds are going to be ringed away from the nets, large numbers of bird bags, holding boxes and/or keeps are needed. One person should be delegated the task of looking after the safety of the birds. Particular care needs to be taken if more than one bird has to be stored per bag; if more than two birds per bag become the norm, it means that preparations for the expedition have been inadequate. To prevent overheating, do not hang bags too close to each other. Some species, such as swallows and martins, are better held in large numbers in holding boxes or keeps. The number of birds per box needs to be carefully monitored; some species stand on top of each other in the corners of boxes if the number per box gets too large. If ringing takes place at a breeding colony (for example, at a quelea colony) birds should be ringed and released as soon as possible and as close possible to the place of capture.

If the ringing operation is to take place at night, headlamps are far preferable to torches. Do not try to extract birds from a mistnet with a torch in one hand; you are liable to injure the birds. Spotlights, motor-car headlights or tube lights also work well. If it is cold, ringers should be dressed warmly. A cold ringer is a potential hazard to the birds. Fingerless mittens are a fantastic invention; they keep the hands warm but allow the ringers full use of the sensitivity of fingers while extracting birds from mistnets.

Especially in the evenings and at night, liberal application of insect repellent helps the extractor to concentrate on the bird in the mistnet rather than the itch on the face. Dress appropriately to reduce the area of skin exposed to insects. It is detrimental to the bird if you are battling to extract it while swarms of hungry mosquitos are intent on your blood.

Similarly, the appropriate precautions must be taken for daytime ringing. Heat is then the main factor to influence both ringers and birds. Ringers must be adequately protected against the elements. Sun-block should be applied liberally and adequate clothing and hats should be worn. Birds and bags containing birds should be removed from direct exposure to the sun as soon as possible. Bird bags should be hung in a shady, airy place. Plan to reduce the size of the catch to numbers that can be handled rapidly in hot weather. No mass ringing whatsoever should take place in rain, or even if rain is threatening.

Hot and cold drinks should be ready and snacks should be consumed frequently. No alcohol should be consumed before or during the ringing session. A session where a thousand birds are ringed may last eight hours or more. The ringer will be on his/her feet and working most of the time. It is worth considering the appointment of one team

member as caterer to take care of the ringers' needs. The programme for the ringing session should be such as to allow ringers enough time before and after the session to rest and relax in comfort. Remember to wash your hands before eating snacks.

The administration of a mass-ringing project is of utmost importance and most of the important work should be done during the expedition. Make a note of the numbers of the ring series to be used, and the order in which they are to used, before ringing starts. The ring numbers actually used should be written down as soon as the ringing is finished. If the coordinates of the ringing site are not known, they should be checked using a GPS or marked on a map. The ringing data should be entered on electronic schedules, carefully checked, and sent to SAFRING as soon as possible. When large numbers of birds are ringed, there is a good probability that the first recoveries will be made within a month or two, and it saves a large amount of administrative complication if the ringing data are already at SAFRING when these first recoveries are made.

Project administration can be simplified and speeded up if a large block of ring numbers is allocated to the target species exclusively. For example, allocate a thousand rings to swallows if this is your target species. The tedium of filling in paper schedules can then be reduced considerably by photocopying the schedules in such a way that only the variants need to be filled in. In electronic schedules it is easy to copy data but care needs to be taken to prevent data errors.

3.9 FIRST AID FOR INJURED BIRDS

Injuries to birds caused by trained ringers are rare (otherwise ringing would not be allowed to take place). However even the most skilled and dedicated ringer occasionally unintentionally injures a bird. Sometimes, birds in a net may hurt one another or even themselves. Sometimes, birds in the net are injured by shrikes or raptors. Sometimes, ringers become the recipients of all injured birds in their neighbourhoods. The ringer should know the basics of how to treat these injuries.

The two injuries that a ringer most frequently has to contend with are minor skin abrasions and birds that are reluctant to fly.

- ❑ Vets have divided opinions on using antiseptics for wild-bird wounds. Antiseptic creams may cause feather pollution. Either leave the wound to heal itself or use an antibiotic powder. Friar's balsam is the best first-aid remedy to stop bleeding.
- ❑ Occasionally, a bird does not fly away when it is released. This is sometimes referred to as wing cramps; some species seem to be more subject to this than others. It is probably caused by stretching of the wing in the net on capture or during extraction or during processing. The best treatment is to replace the bird in its bag and place it in a quiet, warm spot for 15 to 20 minutes after which time it will usually be able to fly away.

It is suggested that all injured birds that are released should be ringed, with the details of the injuries noted down. If the bird is subsequently recaptured, it provides evidence that the bird recovered from the injuries. In cases of serious injury it is better to euthanase the bird rather than letting it suffer.

3.10 BATS

When setting up mistnets prior to dawn, or taking them down after dark, or when leaving nets open to catch nocturnal birds, bats are caught. Bats are potential carriers of rabies, the hydrophobia bacillus. Care needs to be taken to avoid being bitten. On the other hand, bats are a protected species, and must be released uninjured. Normally, if bats are present in any numbers, furl your nets. To remove a bat from a mistnet, hold it by the skin just behind the head and gently pull the strands off, being careful not to damage the wing membrane. It usually helps to hold the bat behind the neck with a bird bag, so that its attempts to bite the extractor are redirected at the bag. Bat removal is carried out more easily by two persons, especially with larger bat species. An alternative method, which some people believe is more simple, is to hold out the finger of one hand, let the bat cling to it, then remove the net strands with the other hand.

Contact people

- Peter Taylor: tel. (031) 300-6218
- Others listed on web-page: www.contra.biology.und.ac.za/big/contacts.htm

4

Metal and colour rings

4.1 METAL RINGS

The rings supplied by SAFRING are mostly metal rings; however, some plastic colour rings are also available. The metal rings have a serial number and a return address stamped on them. Older SAFRING rings state: INFORM ZOO PRETORIA; rings produced since about 1980 state: INFORM SAFRING UNIV. C.T.

Metal rings are the most common and the safest method used for marking or tagging birds. The rings are constructed of aluminium, aluminium alloy (aluminium and magnesium), incoloy and stainless steel, and these have a variety of purposes. SAFRING no longer imports monel rings; those monel rings still in stock were manufactured a long time ago. Metal rings are constructed in different sizes. The smallest SAFRING rings have an inside diameter of 1.8 mm and the largest 26.0 mm.

4.1.1 Aluminium and aluminium alloy rings

The advantages of pure aluminium rings are that they are light, malleable and cheap. Their main disadvantage is that they are soft, rather weak and corrode readily and are therefore not suitable for large, long-lived bird species. For the past decade, the strength of aluminium rings has been greatly improved by using an aluminium alloy. The best aluminium alloy contains 3% magnesium and 0.5% manganese. This has greatly improved the durability of the ring, without sacrificing lightness and malleability. The aluminium rings that are supplied by SAFRING use this alloy. These rings are mainly used on terrestrial (land) birds. Rings made of pure aluminium or of aluminium alloy should not be used on aquatic species. Pure aluminium rings (the soft ones) should also not be used on terrestrial birds with hard, strong beaks. These birds remove or deface the ring, and are alleged to damage their beaks attempting to do so, although very little evidence of this exists. The hard alloy rings do not appear to have this problem.

4.1.2 Incoloy and stainless steel rings

These rings are resistant to corrosion and abrasion. They are, however, more expensive than aluminium and aluminium alloy rings, mainly because their hardness increases production costs. These two alloys should be used to ring birds inhabiting water habitats. Stainless steel is also an extremely durable ring in terrestrial conditions, and ring numbers are still easily legible after more than a decade. Even in seawater, stainless steel

rings are in good condition after 10–20 years. In very saline conditions, however, stainless steel rings seem to corrode faster than incoloy, which consists of 36% nickel, 19% chromium and 45% iron. This appears to be the best ring material for long-term resistance to abrasion and corrosion in the harshest environments.

4.2 RECOMMENDED RING SIZES AND TYPES

The tarsal diameters of birds vary enormously, leading to the wide range of ring sizes. Even within a single species, there are considerable differences between individuals at a single locality. There may be further variation between the tarsi of nestlings and adults, between the sexes, and geographical populations. It is therefore not simple to specify the right ring size for any particular species. Based on the accumulated experience of ringers, SAFRING has produced recommended ring sizes for most species in southern Africa (Appendix 9). However, this is a guide; if in any doubt about the advice offered, measure the tarsus of the bird prior to ringing; this is most easily done with dial callipers. To do this, measure the maximum diameter of the tarsus at three positions, top, middle and bottom. Choose a ring just larger than the biggest of the three measurements. Report any discrepancies in the SAFRING recommendations to SAFRING immediately; if you ring a species not listed, this should also be reported.

4.2.1 SAFRING ring sizes

Note: The prefix usually changes when 100 000 rings of a certain type have been used.

Internal diameter (mm)	Prefixes (current and future)	Material
1.8	X,W	Aluminium
2.3	AE,AF,GA	Aluminium Alloy
2.3	AC,AH	Stainless Steel
2.5 (short shank)	Y	Aluminium
2.5–4.0 (soft overlap)	E,EE	Aluminium
2.8	F,FA	Aluminium Alloy
2.8	F,FH	Stainless Steel
3.0	BD,BE	Aluminium
3.0	BC,BH	Stainless Steel
3.3	CV,CU	Incoloy
3.5	CC,CH	Aluminium Alloy
4.2	4H	Stainless Steel
4.3	4,4A	Aluminium Alloy
5.25	D,DH	Incoloy
5.25	D,DA	Aluminium Alloy
6.0	5A,5B	Aluminium
6.0	5H,5J	Stainless Steel
7.0 (short shank)	PA,PB	Incoloy
8.0	6,6A	Aluminium
8.0	6,6H	Stainless Steel
10.0	K,KK	Incoloy
11.0	7,7A	Stainless Steel
12.5	8,8A	Incoloy
12.5	8	Monel
16.0	9,9A	Stainless Steel
19.0	J,JA	Stainless Steel
26.0	G,GB	Stainless Steel
34	H	Stainless Steel
PENGUIN	P,T,V,S,A,L,M,R,X	Stainless Steel

4.3 COLOUR MARKERS

In order to recognise individuals or cohorts of a population without having to capture them again, many different marking techniques have been tried and developed. Colour marking is thought to affect the bird in the following ways: change their behaviour (the chosen colours might have behavioural significance), increase the rate of predation (by making the bird more conspicuous to predators; and increase the recovery rates (because humans are more likely to spot a colour ring than a metal ring). The overall effects of colour marking have not been proven. As a precaution, therefore, colour marking should only be undertaken when the person conducting the study has a well thought-out project. Large-scale colour-marking projects should only be undertaken if there are no behavioural implications for the species concerned.

4.3.1 Regulations regarding colour marking

To avoid the possibility of conflicts between colour-marking projects, SAFRING must be notified in advance of any plans to colour mark birds. Details must be given of the species involved, approximate number of individual birds that will be marked, duration of the project and the colours that will be used. There needs to be a contact person to whom any sighting reported to SAFRING will be sent. Colour markers must be used in combination with metal rings. No experimental marking technique should be used without informing SAFRING and obtaining permission from the relevant conservation authority.

4.3.2 Plastic colour rings

Colour-ringing projects are of two types: those in which it is desired that cohorts of birds should be recognisable, and those for which individual birds need to be identified with unique patterns of colour rings.

In the former case, the most common scenario is to use a single colour to indicate all birds ringed at a particular site or in a particular year or both. Individual birds are not distinguishable at a distance, although of course each bird also has a numbered metal ring.

Patterns of colour rings are usually applied when it is necessary to identify individual birds at a distance. Provided the chosen species is one whose tarsi are easily seen, colour rings usually provide the most efficient and cost-effective system for individual bird recognition, and are the easiest system to use. The set of rings on a bird usually last for at least several years before even the first ring is lost. The number of colour rings used

per leg should be as small as possible, consistent with providing enough unique colour permutations. SAFRING can give advice on these choices.

It is preferable not to place a soft colour ring and a hard metal ring together on the same leg – the harder metal will wear the softer plastic ring away. If it must be done, place the plastic ring above the metal ring. The golden rule of colour ringing is this: **the same number of colour rings should be placed on each bird in a specific study**; otherwise it will not usually be possible to detect birds that have lost a ring. It is for this reason that colour ringing projects need to be carefully planned in advance, so that growth of the number of birds ringed does not necessitate the later use of extra colour rings. If possible, the left and right leg should not be used as a means of obtaining twice as many colour combinations, because many observers find it difficult to make reliable observations as to whether the colour rings were on the left or the right leg. The concentration required to get the colours correct somehow seems to overrule the crucial additional piece of information: was the bird facing towards the observer or away from him? The designers of colour-ringing projects need to be realistic; it is a good idea to mark a few birds and to monitor these closely.

The best colours for colour rings are red, blue, yellow, black, white and green. However, black is not very visible on a bird with a black tarsus, green cannot easily be seen amongst green foliage, reds may fade to look like pink or pale purple after some time, and blues become pale white. So before commencing a colour-ringing project choose your colours with great care.

It is important to solicit the assistance of members of the public including members of the appropriate bird clubs, in searching for your colour-marked birds. The information given to the media and to anyone not in the inner circle of project assistants must be clear and simple. **Report all sightings of colour-marked birds to SAFRING, giving details of date, place and the colour markings observed.** It is not good practice to ask for sightings to be made directly to the project. As the number of colour-marking projects increases, we aim to avoid the situation where there is confusion about where to send a particular sighting. The message that goes out to the public must be clear and simple: report to SAFRING.

SAFRING is the main supplier of colour rings, which are made of various materials.

4.3.2.1 Celluloid rings

Split celluloid rings are mainly used for passerines; a wide range of colours is available but some colours fade badly with time. These rings are applied by using a special tool which comes with the rings, and which is used to open the ring so that it can be slipped over the leg. The split in the ring may be sealed by applying acetone with a small brush accurately on the sides of the split; immediately afterward, a little pressure should be applied on the ring until the split sides have bonded together. This helps to prevent ring loss. The acetone should be applied carefully; otherwise the whole ring gets soft and sticky.

4.3.2.2 Darvic and Vinylast rings

PVC rings (Darvic coil or Vinylast) are normally used on larger birds, although they are available in sizes down to 2.8 mm. They are generally colour-fast. These rings are spirals like the mainspring of a clock. The rings are applied by opening the spiral and slipping it on to the bird's leg.

Darvic and Vinylast rings are also manufactured from two-layer plastics which are laminated together, using two contrasting colours of plastics. These rings can be engraved through the outer layer of the ring to expose the inner layer of the second colour. Figures, letters and numbers can be engraved on the ring which make it possible to identify the bird uniquely. These rings usually have two bright and contrasting colours so that the inscription is legible in the field from a distance with a pair of binoculars or a telescope. Ring spotting of these rings is a new branch of birding with an increasing number of addicts; in Europe and the USA, birders can be seen hunched behind their spotting scopes at estuaries and open fields reading the engraved ring numbers of gulls, waders and storks. Rings like these are used in large-scale research projects. Currently in South Africa, these engraved plastic rings are being used on Hartlaub's Gulls, Swift Terns and African Black Oystercatchers. We hope that ring spotting will become as popular a branch of birding in southern Africa as it is elsewhere.

4.4 SPECIALIST TECHNIQUES

These are generally not used by SAFRING ringers, but are mentioned for the sake of completeness. Wing or patagial tags, nasal saddles, collars, harnesses and dyes are used when it is necessary for specific research projects to be able to identify individual birds from a distance. Any bird seen with any of these types of markers should be reported to SAFRING. SAFRING can also supply more information on these methods.

4.5 ORDERING RINGS

Use good judgement when ordering stocks of rings and anticipate your requirements well in advance, particularly with special orders, to prevent a last-minute rush. On the other hand, do not order more rings than you are likely to use over a reasonable period of time. From SAFRING's perspective, it is more efficient to process a smaller number of substantial-sized orders per year than a large number of small orders. The labour costs involved in preparing an order for dispatch are more or less independent of order size, and these costs need to be factored into the prices of rings.

4.6 RECORD KEEPING

SAFRING keeps a register of all rings issued to each ringer. This enables the system to determine to whom a ring was issued if the bird it was placed on is recovered before the ringing data arrives at SAFRING. All ringers need to be able to account for all rings issued to him/her at any point in time. If asked to do so by SAFRING, lists must be submitted of all the unused rings in a ringer's possession. Rings may be transferred from one qualified ringer to another; it is essential that the ringer handing over the rings supply SAFRING with a detailed list of ring numbers transferred. If a ringer ceases to ring, unused rings should either be transferred to another ringer, or returned to SAFRING.

5

Ringing

5.1 RINGING EQUIPMENT

Bird ringers need to equip themselves with the basic tools for fieldwork. Apart from being able to affix rings in the best possible way, ringers usually need to weigh and measure the birds handled. The financial outlay is considerable, but less than taking up many other hobbies. Most of the equipment lasts for years without need for replacement, if properly cared for.

5.2 EQUIPMENT REQUIRED ON THE RINGING TABLE

- ❑ rings in holding container
- ❑ SAFRING recommended ring-size guide
- ❑ small ringing pliers
- ❑ large ringing pliers
- ❑ stainless steel wing rule (15 cm, 30 cm)
- ❑ stainless steel tail ruler (optional)
- ❑ spring scales 0–100 g/0–2000 g
- ❑ vernier or dial callipers
- ❑ pencil/pen
- ❑ data-recording sheets
- ❑ bird moult cards
- ❑ bird identification guide
- ❑ torch or headlamp
- ❑ friar's balsam, mercurochrome
- ❑ ear-buds
- ❑ fishing line
- ❑ crochet hook (1.75 mm)
- ❑ nail-cutter or pair of small scissors
- ❑ circlip pliers

5.3 BASIC CAPTURE EQUIPMENT AND AIDS

- ❑ net poles
- ❑ pole pegs
- ❑ nets

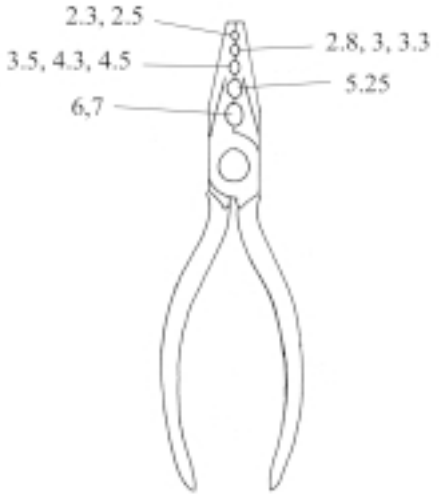


Fig. 5.1. Small pliers.

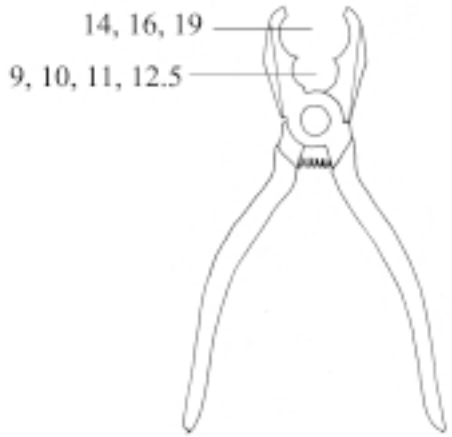


Fig. 5.2. Large pliers.

- ❑ guy ropes and pegs
- ❑ hammer
- ❑ bird bags
- ❑ slasher/panga
- ❑ large pruning shears

5.4 PERSONAL EQUIPMENT

- ❑ insect repellent
- ❑ sun-tan lotion
- ❑ refreshments
- ❑ assistants!

5.5 PROCESSING EQUIPMENT AVAILABLE FROM SAFRING

5.5.1 Ringing pliers

Three types of ringing pliers are used, of which the first two are only available from SAFRING, and the third from a hardware store. The small ringing pliers are basically long-nose pliers with a series of holes drilled through them with the pliers closed. The diameters of these holes are designed to close rings with internal diameter sizes ranging from 2.3 mm to 7 mm (Fig. 5.1). The large ringing pliers are used for 8 mm internal diameter ring sizes and above (Fig. 5.2). The third type of pliers used by ringers are Elliot Lucas pump pliers, bought at hardware stores; these are especially useful for closing the large rings of hard metal, e.g. 10 mm Incoloy and sizes above this. They are also used for closing penguin flipper bands.

5.5.2 Spring scales

While any type of scale or balance can be used for weighing birds, the most suitable and reasonably accurate types for fieldwork are the Pesola or Salter spring scales. The Salter scales are cheaper than the Pesola; although they are most probably less accurate, they are easier to read. Care should be taken to check the zero value of the spring balance at regular intervals. It is also a good idea to have a set of standard weights, and check that the balance continues to show the same values for these weights at regular intervals. Several weight ranges of spring balance are available, each suitable for different weights of birds.

Electronic balances can also be used. Although these are more expensive than spring scales, a given balance usually has a wider range; it may be possible to use one balance instead of several spring scales which may be needed. Electronic balances are generally more accurate than spring scales; birds can probably be weighed faster on an electronic balance.

5.5.3 Stopped rule

This consists essentially of a metal ruler graduated in millimetres with a 'stop' at one end. It is used for measuring wing lengths, and can also be used in conjunction with a pair of dividers for measuring bill, tarsus, tail length (although most ringers favour an unstopped rule for this measurement) and total length. SAFRING sells small (150 mm) and large (300 mm) stopped rules with the stop riveted to the ruler. Suitable stopped rules can also be made by purchasing a ruler which is graduated from the very end. To make the stop, take a piece of 12.7 mm or 19 mm aluminium or stainless steel angle, make a bracket the same width as the ruler, and fasten the bracket to the end of the ruler by sticking it on with an epoxy cement or get it spot-welded or riveted at a plumber or engineering firm. A problem with the epoxy cement is that it eventually dries out and, when the rule is dropped, the stop comes off.

5.5.4 Vernier callipers

These are used for measuring the culmen, head and tarsus (length and width). They can be obtained from hardware stores. Callipers vary from the cheapest plastic models (not recommended) through the fibreglass dial types (strongly recommended) to the most expensive stainless steel type with digital read-out and memory. The edges on the stainless steel types need to be sanded down with very fine water sandpaper to avoid cuts and other injuries to the birds.

5.6 PLACING THE RING ON THE BIRD

The SAFRING ring guide gives a good indication of which ring should be used for which bird. To determine ring size independently of the guide, measure the thickest part of the tarsus at three positions, top, middle and bottom. A bird's tarsus is usually oval or egg shaped, and the largest measurement is from front to back. Choose a ring size immediately larger than the biggest of the three measurements. For example, if the measurements were 2.9 mm, 2.7 mm and 2.8 mm, choose a 3.0 mm ring. If the bird is

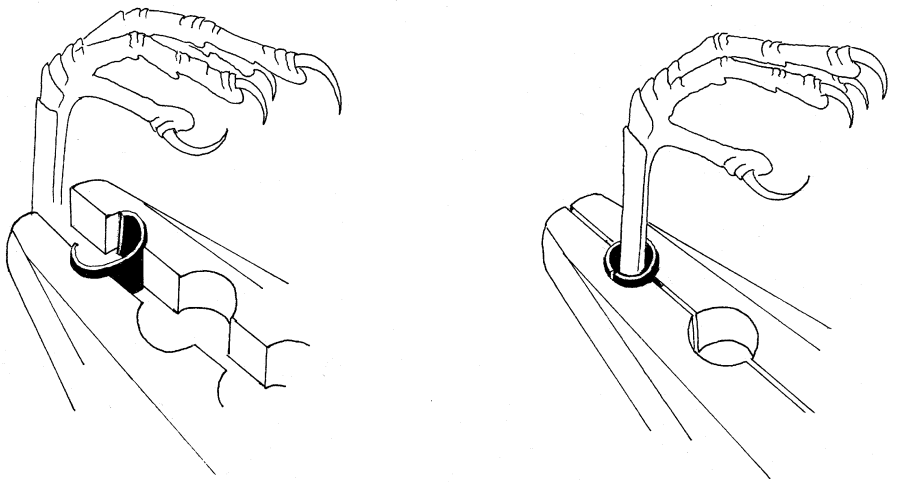


Fig. 5.3. Placing a metal ring on the leg of a bird.

aquatic, for example a duck, plover or sandpiper, use a stainless steel ring on that bird. If it is a bird of a species that does not normally wade or swim, use a hard aluminium alloy ring. The idea that weavers, shrikes and barbets can remove aluminium alloy rings has largely been disproved by the number of birds of these species recaptured with the rings intact and undamaged. Using aluminium alloy rings for terrestrial species considerably reduces the cost of ringing and is also safer for the birds because aluminium rings are easier and quicker to close than stainless steel rings, reducing overall handling time.

Extra care must be taken with ringing nestlings. If they are too young, their tarsi may either be thinner or thicker than tarsi of adult birds. This is where the SAFRING guide must be used. A good rule when ringing nestlings is: **if the recommended ring size for the adult appears to provide an incorrect fit, do not ring it**.

The ring must be placed on the tarsus, i.e. on the leg bone immediately above the toes. The ring should be closed with the pliers so that it is almost perfectly round. The ring should be loose enough for it to move freely up and down the tarsus and also be able to turn around. On the other hand, it should be tight enough that it cannot slide over the joints above and below the tarsus and tight enough that objects cannot easily catch between the ring and the tarsus. The ends of the ring should butt tightly, so that nothing can slip through the gap, and squarely, so that there are no projecting corners.

Hold the bird in the standard ringer's grip with its right leg between the thumb and index finger. Place the ring over the tarsus with the left hand, and hold the ringing pliers in the right hand (left-handed ringers place the ring on the bird's left leg with the pliers held in the left hand). All ring sizes from 2.3 mm to 7.0 mm internal diameter should be slipped into the appropriate hole of the ringing pliers and the gap in the ring aligned with the front of the pliers. Choose the correct pliers-hole and squeeze the pliers gently until the two ends of the ring meet, and the ring can no longer be removed from the tarsus (Fig. 5.3). Open the pliers, swivel the ring through a right angle, so that when

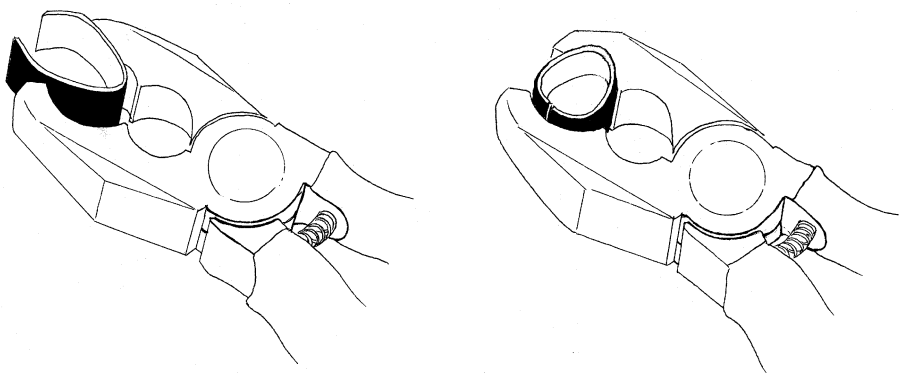


Fig. 5.4. Closing a U-shaped ring with pliers.

the pliers are closed again, the ends of the ring are both within the same closed half of the pliers hole. Apply pressure gently. If the gap between the ends of the ring is completely closed and the ring butts perfectly, the job is done. If not, swivel the ring around through another right angle. Apply pressure gently with the pliers again, and check again whether the ring is completely closed. Repeat as many times as necessary. With stainless steel rings, this process needs to be repeated several times before the ring is closed. Objects, e.g. thread, can slip through this gap so that the bird may become trapped.

In the case of 1.8 mm aluminium rings, the first hole of the pliers is too large to close the ring completely and a gap will always remain; to close this gap the front flat part of the pliers should be used. Considerable care is needed. Alternatively, ringers who possess excellent fine motor control can use their fingers to put on and close a 1.8 mm ring.

Some sizes of incoloy, monel and larger stainless steel rings are U-shaped. Although the shape is counter-intuitive to trainee ringers, and gives them problems, the design is deliberate. For a skilled user of these rings, the U-design enables the rings to butt perfectly, but this requires some careful manipulation (Fig. 5.4).

There is no consensus whether the numbers on the rings should be the right way up or upside down when the rings are on the birds' legs. Ring spotters, some of whom even read the numbers of metal rings with a telescope, prefer the ring numbers to be the right way up.

The technique for putting a U-shaped ring on a bird has the following steps:

- ❑ Apply pressure to one end of the ring and turn that side of the ring in slightly.
- ❑ Apply pressure to the other side of the ring and turn that side of the ring in slightly.
- ❑ Repeat the first stages until the two ends of the ring meet. It is better to make several repetitions, closing the ring slightly each time, rather than to do so only once using maximum force. The latter may cause the pliers to slip or the ring to close too far. The ring will now have a teardrop shape.
- ❑ Swivel the ring round so that the ring abutment is at right angles to the opening of the pliers and apply pressure. This should cause the ends to come together tightly and the ring to bend into shape.

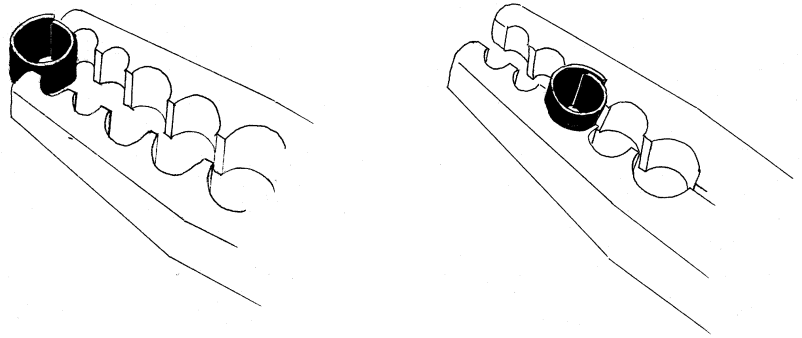


Fig. 5.5. Overlapping a ring.

The large 26 mm internal diameter clip rings can be closed by hand and the flange turned over with pliers.

Special skills are needed to put flipper bands on penguins. Ringers in the Western Cape are sometimes needed to put bands on de-oiled penguins at SANCCOB after large numbers are impacted by oil spills. Ringers in this region should try to learn these skills before an emergency arises, and keep in practice.

The technique of closing rings is best demonstrated practically. It cannot be learned from a manual. On-the-job training is essential.

5.6.1 Overlapping rings

It is sometimes necessary to overlap the ends of a ring to obtain the best fit. After the ring has been almost closed in the normal way, the ring should be held in the front flat part of pliers so that pressure is put on the one end of the ring. This will cause this end to bend inwards. Then swivel the ring so that pressure is now put on the other end of the ring; hold it in the appropriate plier hole to do this. This causes the two ends to overlap by sliding past each other. By swivelling the ring round and by applying light pressure at various points it is possible to shape the ring to the desired form (Fig. 5.5). In all operations it is best to apply several sets of light pressure rather than one large effort. Overlapping rings is a skill that requires fine motor control.

5.7 HOW TO REMOVE A RING

Rings usually need to be removed when they were fitted too tightly or if the person applying the ring overlapped the ring inadvertently. Badly worn rings, both from SAFRING and foreign schemes, need to be removed when birds are recaptured, and replaced with a new ring of the appropriate alloy. Sometimes steel and incoloy rings, which tend to spring open when one is trying to butt the two ends, overlap suddenly if too much pressure is applied, resulting in the ring fitting too tightly. Birds must never be released with incorrectly fitted rings. Removing a ring is usually easier if two people

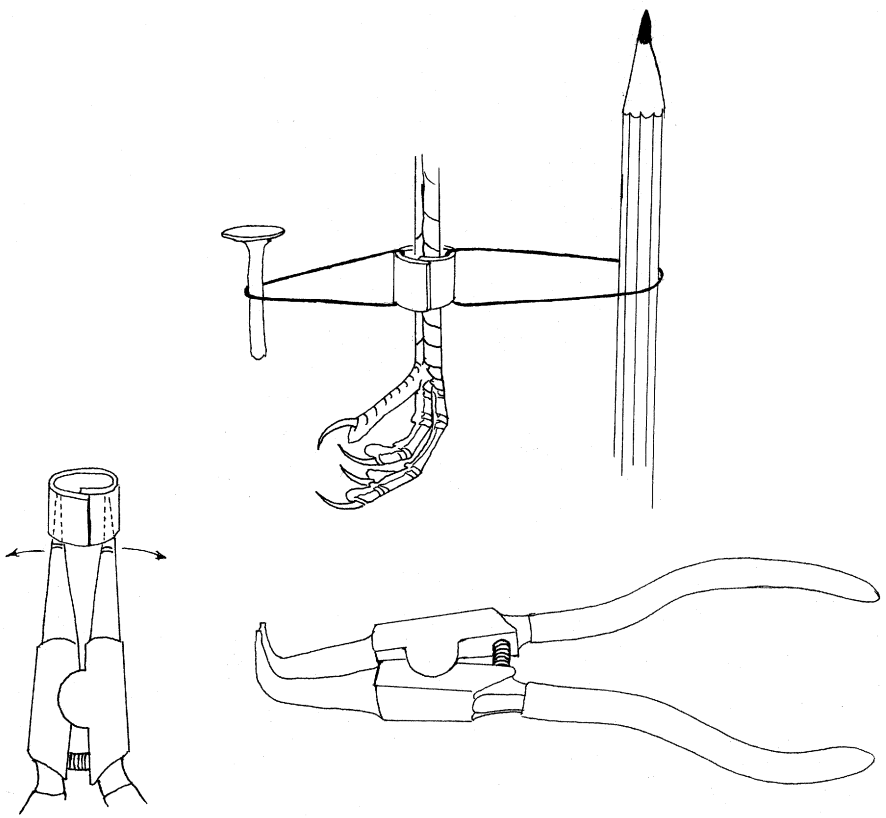


Fig. 5.6. Removing a badly fitted ring.

are involved (Fig. 5.6). The best way to avoid the nuisance of removing an incorrectly fitted ring is to put it on properly first time.

- ❑ It is almost invariably difficult to remove a ring. Aluminium alloy rings can be removed by enlarging the ring opening with a pocket knife or, better still, a jeweller's screwdriver. You can then insert your finger nails to further the opening to get it off the bird's leg.
- ❑ Another method is to insert two strands of strong steel wire (guitar or piano wire), one strand on each side of the ring. Tie the two pieces of wire into two circles and hook one over a fixed projection, insert a pencil through the other, then carefully pull to open the ring.
- ❑ Specific pliers have been devised for removing rings from birds' legs, and circlip pliers are handy for removing large rings.
- ❑ Another method for removing a ring uses a metre length of nylon fishing line, with a breaking strain of about 10 kg. Leave the bird in the bag and expose just the leg with the offending ring. Place the bag and the bird on your lap, with the leg towards you. Push the one end of the nylon line through the gap between the ring and the tarsus and extend it for 30 cm. Push the other side of the line through the gap on the opposite side of the tarsus and extend for 30 cm. The line on the one side of the ring is taken into one hand and the line on the other side is taken in the other hand. Pull your hands apart, thereby forcing the ring to open without putting any pressure on the bird's tarsus. The fishing line is thin enough to go through the gap between the tarsus and the ring, yet strong enough not to break. An even thinner line can be used to open the smaller rings.

If the tarsus was scratched and the leg is bleeding, mercurochrome or friar's balsam should be applied and the bird should be kept in a bag for a period of time to recover before another ring is fitted (on the other leg) and the bird allowed to go free. Sometimes, a ring which has been removed can be reshaped and smoothed by closing it around a round object like a crochet needle, pencil or the handle of the pliers. Check that all the lettering is still legible.

5.8 RINGING NESTLINGS

Nestlings should be handled with extreme care when they are ringed, and should never be ringed in bad weather conditions. The best age at which to ring nestlings will vary, depending on which species are being ringed.

For most passerines ringing should take place when they are between six and eight days old, i.e. when the feathers are in pin or just beginning to emerge. Do not ring chicks with feathers sprouted, as they tend to explode out of the nest and are not likely to survive. In the case of a single nest this can be prevented by covering the nest with a dark cloth and taking the young out underneath the cloth one at a time and placing each one back as soon as it is ringed.

In the case of precocial birds (where the young leave the nest shortly after hatching) one has to be careful when ringing young birds. Gamebirds such as francolins, guineafowls, korhaans, quails, sandgrouse, ducks and geese should not be ringed at all until the young are fully grown because in these species the tarsi grow until the young birds reach adulthood. On the other hand, the young of waders and plovers can be ringed on the day of hatching; the legs of the young are remarkably well developed, and are virtually the identical thickness to those of the adults.

Special precautions should be taken when ringing nestlings in breeding colonies. This applies particularly to gull and tern colonies, and to heronries, where besides herons and egrets, ibises and cormorants may breed colonially. No ringer should attempt to ring in these situations without special training.

6

The bird in the hand

6.1 INTRODUCTION

The obvious reason for ringing birds is to mark individuals so that they can be recognised if they are encountered again later on, either as retraps, resightings or recoveries. From these records, knowledge about migration, dispersal, survival rates and longevity is obtained. However, a great deal of additional information can be gained from the bird in the hand. This information is important to understanding the biological processes and life histories of many poorly known and poorly studied species.

When birds are caught for ringing purposes, the opportunity should be taken to collect appropriate biometric data, as well as information on moult. There are many biometric measurements that can be taken but many of these are unnecessary or redundant. Measurements should be restricted to those that are important for the particular species, and these vary from species to species.

An important project on which little progress has been made is the production of a comprehensive guide for ageing and sexing southern Africa's bird species. Some general principles are described in this chapter. Moult is another aspect of the life history of southern African birds that needs more attention and to which ringers are excellently placed to make a major contribution.

Many of the principles that are used for ageing and sexing are not easy to apply, and they present a challenge more difficult than any crossword puzzle. Many ringers have derived an enormous amount of personal satisfaction by developing theories of how to age and sex the birds of a species, testing the ideas, revising and refining them. They write up their methods in *Safring News*, where other ringers can use the methods at their ringing sites, and perhaps fine-tune them further.

Likewise, understanding the basics of moult is not trivial. The process of moult is a vital component of the life history of birds. The importance of moult comes into sharp focus when one realises that, by moulting their flight feathers, most birds effectively replace their organs of locomotion every year. Their strategies for doing this must therefore be a critical component of the study of birds.

6.2 GLOSSARY

To be able to identify and describe a bird in the hand it is essential to be familiar with the topography of a bird. Maclean (1993) gives the topography of a typical passerine bird.

It is advantageous if all ringers use the same terminology to describe the different parts of a bird because this will simplify communication and the use of references. In the glossary below, the meaning of some terms used by ringers are given.

Abdomen – the part of the body containing the stomach, bowel and reproductive organs.
Adult – a bird that has reached its fullest development.
Alar – of the wing.
Alula – the bastard wing, the quill feathers attached to the first digit.
Anterior – more to the front, opposite of posterior.
Bare parts – or soft parts, all areas of the body not covered with feathers, namely the bill, gape, eyes, legs, feet and wattles.
Belly – the same as abdomen.
Brood patch – or incubation patch, bare patch developed on the abdomen of most incubating birds.
Carpal joint – carpus, the foremost point of the folded wing.
Caudal – of the tail.
Cere – the fleshy covering of the upper part of the upper mandible in certain orders of birds – e.g. raptors.
Cloaca – the vent, a body exit, serving both excretory and sexual functions.
Cloacal protuberance – the swelling around the cloaca – often used for sexing birds during the breeding season.
Contour feathers – the outer feathers covering the body. Usually applied only to the small body feathers (but strictly speaking they include all the wing and tail feathers).
Coverts – contour feathers that overlie the bases of flight feathers. Also feathers that cover the ear opening.
Culmen – the central ridge of the upper mandible.
Dimorphic – of a species occurring in two forms, frequently referring to differences between the male and female.
Distal – farthest from the centre of the body or from the point of attachment, e.g. a limb; the opposite of proximal.
Dorsal – of the back or upper surface, opposite of ventral.
Emargination – a step or abrupt narrowing of the web of a primary feather occurring towards the tip. Usually restricted to the outer web.
Eyebrow – or eye stripe or supercilium . The feather marking, often a stripe, over the eye.
Feather tract – in nearly all species the feathers are not distributed evenly over the body, but in a series of groups known as tracts – e.g. spinal, ventral, etc. The feathers in a tract usually moult at about the same time.
Flight feather – the primary, secondary and tail feathers.
Furculum – the wishbone, formed by the fused clavicles. Sometimes used to denote the depression or pit at the base of a bird's neck, which lies between the fused clavicles.
Gape – the open beak.
Gape flange – the protuberant, often brightly coloured, skin in the angle between upper and lower mandibles of young birds.
Greater coverts – collective term for the primary and secondary coverts.

Growth bars – alternate, often barely visible, bands of darker and lighter shading in feathers.
Immature – a bird which is not an adult.
Iris – the coloured part of the eye which surrounds the dark pupil; it may show inner and outer rings of different colour.
Juvenile – a free-flying bird still under parental care.
Mandible – the upper or lower parts of the beak.
Morphometrics – the study of the data of the measurements of the size and structure of birds.
Notch – an abrupt narrowing of the inner web of a feather, usually a primary.
Nuchal – of the nape, i.e. at the back of the head.
Orbital – surrounding the eye.
Patagium – the fold of skin, covered with tiny feathers, which links the forepart of the wing with the body.
Posterior – more to the rear, opposite of anterior.
Polymorphic – a species occurring in several forms, e.g. Ruff.
Preen gland – a gland situated immediately above the base of the tail feathers and secreting oil used in preening.
Primaries – the outer remiges, growing distally from the carpal joint.
Proximal – towards the inside, nearer the body; the opposite of distal.
Rachis – or shaft; the strong, tapering central quill of the feather.
Rectrices – the main tail feathers.
Remiges – collective term for primaries and secondaries.
Rictal bristle – bristles situated at the angle of the gape.
Secondaries – remiges growing from the ulna.
Tarsus – properly it is called the tarsometatarsus, the bone between the ankle and the toes.
Tertials – the innermost secondaries; their tips do not usually line up with those of the true secondaries on the open wing.
Tongue spot – contrasting dark spots found on the tongues of nestlings of many species; often retained for months and thus sometimes a pointer to age.
Tracheal pit – sometimes referred to as the furculum (q.v.) A standard place for assessing fat deposition.
Ventral – the under-surface of body, wing, etc., opposite of dorsal.
Web – of a feather, the vane projecting from either side of the shaft.
Wing point – the number of the longest primary feather, measured from the carpal joint.

6.3 MEASUREMENTS

6.3.1 Reasons for measuring

Many measurements can be taken from the live bird in the hand, but it is each individual ringer's choice which measurements to take. This is determined by the specific project that the ringer is working on or whether general data are being gathered.

The lengths of the wing, beak, tarsus, head and tail have a long tradition of being the fundamental taxonomic measurements of birds. These measurements may be of value:

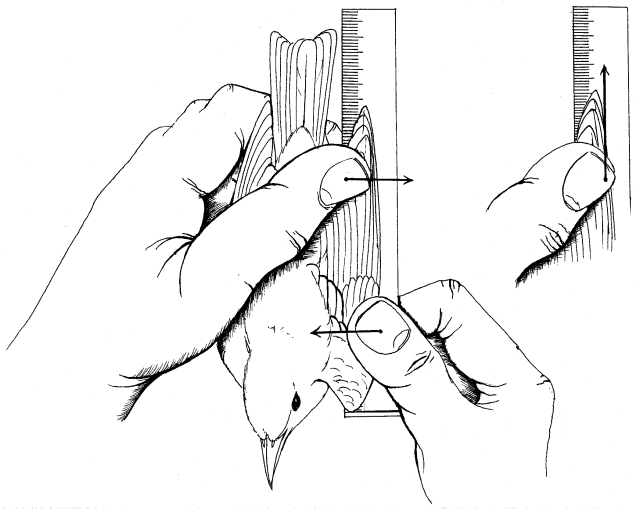


Fig. 6.1. Measuring the wing length of a bird. The bird should be held in the 'ringer's hold' (see Fig. 3.5 on page 21). The bird is only shown here in this position for clarity.

- ❑ in separating races of the same species;
- ❑ in distinguishing sexes;
- ❑ in studies of the growth rate of juveniles;
- ❑ in studies of the growth rate of remiges and rectrices and the process of abrasion;
- ❑ in mass studies, to provide a measure of an individual's body size.

6.3.2 Wing length

Wing length is defined as the distance on the closed wing from the foremost extremity of the carpus to the tip of the longest primary feather. The bird wing is not a simple structure, for apart from the lateral curvature of the primaries there is also a camber along and across the wing. There are three ways of measuring wing length, depending on the extent of wing flattening. A stopped rule is needed for all three methods of measurement.

- ❑ Unflattened wing, giving minimum chord measurement. **Not recommended.**
- ❑ Flattened chord, giving an intermediate value. **Not recommended.**
- ❑ Flattened straightened wing, giving maximum measurement. **Recommended method.** (Fig. 6.1)

The only acceptable way to measure wing length is the third method, usually known as the 'maximum chord method', although this is not very descriptive of the method. This method is adopted for international exchange of data by bird ringers. This method has been demonstrated to be the one that gives the most repeatable and consistent results. If two trained ringers use the maximum chord method, the results they get are, on average,

closer than the results obtained with the other methods. Because all the curvature is not removed, the other methods give wing-length values which are shorter than the maximum chord method. For the purpose of standardisation only the maximum chord method will be described.

Slide a stopped rule under the naturally folded wing and press the carpal joint gently but firmly against the stop, make sure that the wing does not spread during this operation. Gently apply pressure on the median or greater coverts; this will flatten the wing against the rule. This removes the camber along and across the wing. To remove the lateral curvature, straighten the alula so that it falls in line with the longest primary. Now straighten the longest primary by stroking the thumb of the free hand along the shafts of the primaries, from the base to the tip, pressing firmly against the rule all the time. Never pull the tip of the wing; a firm stroking action will straighten the wing. This method has the smallest margin of error of the three methods. Small differences in measurement will occur owing to the variation in the degree of straightness achieved, but the method does eliminate inaccuracies caused by the alteration of the lateral curvature during trapping and handling or caused by dampness. Measure the wing length to the nearest 1 mm.

The most common mistake made when using this method is the failure to keep the wing in a natural position as close as possible to the bird's body while taking the measurement. This will lead to inaccurate measurements.

Do not measure wing length if the longest primary is in moult and not fully grown. Old feathers have worn tips, and abrasion over the year between moults may lead to an apparent shortening of wing length by 2–3%. When reporting wing lengths, for example in *Safring News*, state that the maximum chord method was used.

The wing lengths given in fieldguides and handbooks are often derived by averaging the wing lengths reported in many publications. Many of these refer to wing lengths of museum specimens, in which the wing lengths shrink by approximately 2%. Others refer to wing lengths measured by the two methods that underestimate the correct value. Ringers need to understand that the published wing lengths in books are mostly 1% or 2% smaller than they ought to be. This has implications for using the wing lengths published in these books to sex birds.

6.3.3 Wing formula

The wing formula of a bird consists of the measurements of the primary feather lengths in millimetres in relation to the length of the longest primary feather (Fig. 6.2). The wing formula can be used for identification purposes; specifically so for some of the more difficult species, e.g. Palearctic warblers, where some species can only be positively identified by using this technique. Little work has been done on the wing formulae of passerine species in southern Africa. Most passerines have 10 primaries of which the outermost is very often reduced or in many cases vestigial. In wing-formula studies the primaries are, by tradition, numbered in the opposite direction from that in which they are numbered in moult studies: from the outermost, number one, to the innermost number ten. Secondaries are always numbered inwards towards the body.

When the wing formula is determined, the bird can be held in two ways. Some ringers prefer the standard ringer's hold with the tail towards the wrist while others use the reverse ringer's hold with the head towards the wrist. Each individual must determine

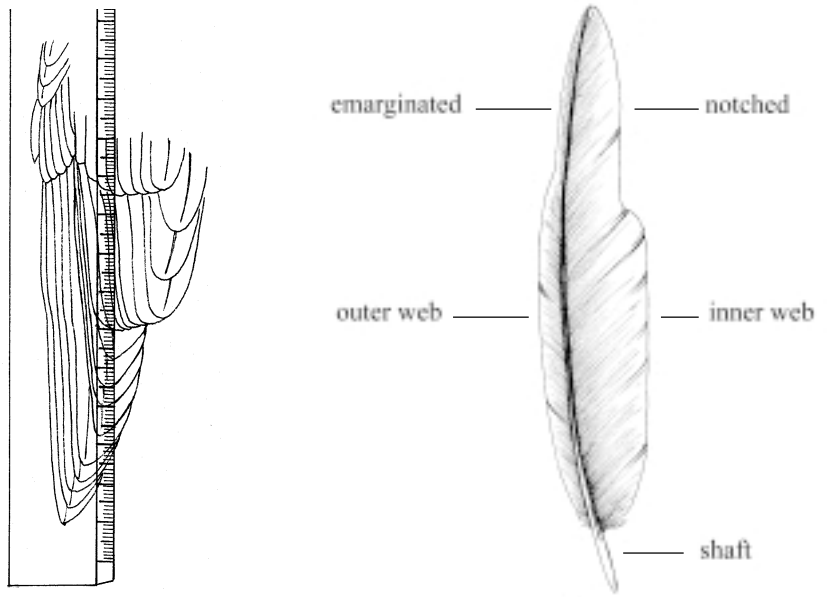


Fig. 6.2. Recording wing formula; parts of a contour feather.

the most comfortable method to use. The first step is to determine whether there is any accidental loss of feathers, by counting the number of primaries. The next step is to determine whether there is any moult in the wing. This is done by looking at the base of the critical feathers for signs of the glossy, grey or greyish-white waxy feather sheaths. When satisfied that the wing is complete, gently put the tips of the feathers in order; these may become disarrayed when the bird is kept in a bag or a box. When determining the wing formula the wing must not be extended; all that is necessary is to splay the feathers slightly so that the tips of all the primaries are visible. If the first primary is very short, then the length is given as so many millimetres longer or shorter than the primary coverts measured along the edge of the wing. This measurement is taken between the point of the first primary and the point of the longest primary covert. The lengths of the other primaries are all expressed as so many millimetres shorter than the longest primary or wing point. Place a transparent rule on top of the naturally folded wing with the scale visible right against the tips and measure the difference in length between each primary and the longest primary. For completeness the distance between the longest primary and the outside secondary can also be measured.

Where emargination of the outer web of the primaries occurs (these are feathers that have a visible narrowing of the outer web), the specific primaries should be recorded. In many cases the emargination is not very distinct and therefore it is not possible to take accurate measurements. Emargination can in some cases be very slight and difficult to see. If the feathers are heavily worn and abraded, the emargination can sometimes not be seen at all.

In some bird species there is an abrupt narrowing of the inner web of the primaries,

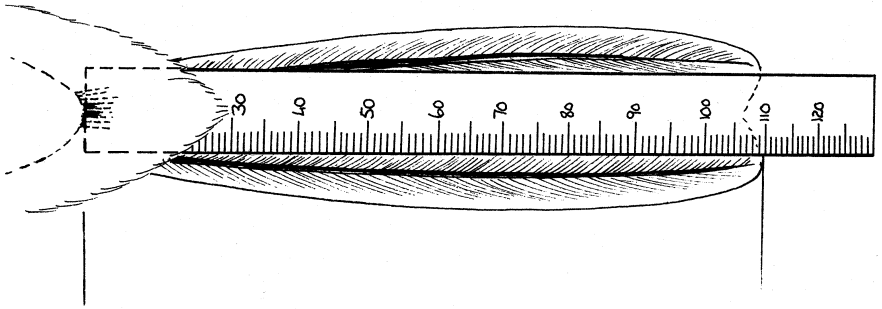


Fig. 6.3. Measuring the tail of a bird.

known as the notch. This is normally distinct and can thus be measured. The notch is considered to be from the point of the primary to where the inner web starts to widen. This measurement is taken between these points and not along the shaft of the feather. The length of the notch in relation to the tips of the other primaries can be diagnostic in the identification of some species. It must be stressed that this method is not foolproof and should only be used in conjunction with all the normal methods of identification, namely measurements, plumage colour and structure. False measurements will also be obtained if there is wing moult or when feathers are heavily worn. In such cases this method should not be used for identification purposes. Whenever this technique is used to identify a species, the measurements should be taken in both wings.

Where the symbols > and < are used, the open end of the > is against the longer feather e.g. P2 >P6 means primary 2 is longer than primary 6.

6.3.4 Tail length

To measure the tail, slide a rule between the rectrices and the undertail coverts until it comes to a stop at the root of the central pair of tail feathers (Fig. 6.3). If necessary, straighten and flatten the tail, and measure the longest feather. Measure to the nearest 1 mm. Do not take measurements from above, as this may damage the preen gland. The rule should not be placed between two tail feathers because this will give inaccurate measurements. A bird's tail may be rounded or forked. The graduation or fork is measured from the tip of the longest to the tip of the shortest tail feather. Measure along the long axis of the tail.

6.3.5 Culmen length

When taking this measurement, utmost care should be taken to prevent injury to the bird's face and eyes; make use of vernier callipers instead of dividers. There are three ways of measuring the culmen length from the bill tip: to the cere, or to the feathering, or to the union with its skull (Fig. 6.4). The most common method used for passerines is from the bill tip to the union with the base of the skull; for owls and birds of prey it is from bill tip to cere; for waders and long-billed birds normally the bill tip to feathering is used. A measurement not recommended is from bill tip to the nostrils. Always

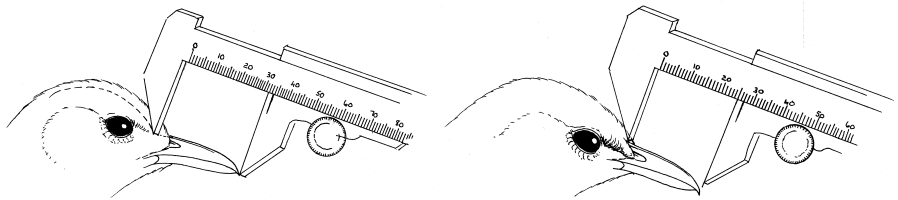


Fig. 6.4. Measuring the culmen of a bird (to the skull; to the feathering).

record the method used in all records, correspondence and publications.

Open the callipers wide enough so that the opening between the outer and inner calliper is greater than the culmen length of the bird being measured. Carefully push the outer calliper along the culmen to the angle in front of the skull; this is usually covered by feathers. Now close the inner calliper until the point of the culmen just touches the inside point of the calliper. Take the measurement to the nearest 0.1 mm. When measuring to the cere or feathering, place the outside calliper at the base of the cere or at the base of the foremost feathers of the forehead (not at the tip of these feathers).

6.3.6 Width of bill

The beak width should always be measured at the point where the exposed culmen begins, that is, where the beak is hard. This will normally give the largest measurement. If this is not the widest part of the beak, also record the maximum width. Avoid measuring over the soft parts of the gape. Report to the nearest 0.1 mm.

6.3.7 Depth of bill

Place the inner calliper on the edge of the lower mandible and the outer calliper on the culmen at the edge of the feathering or at the proximal edge of the nostrils and report to the nearest 0.1 mm (Fig. 6.5). Always record where the measurement was taken.

6.3.8 Tarsus length

This measurement is actually the length of the tarsometatarsal bone. It is measured by placing the one calliper in the notch of the intertarsal joint and the other at the lower edge of the last complete scale before the toes diverge (Fig. 6.6). In another method, the foot is bent downwards to approximately 90 degrees to the tarsus, and measured from the notch of the intertarsal joint to this point. This gives more reproducible measurements than the first method. This last method is the prescribed method of the European–African Songbird Migration Network; for purpose of international standardisation this is the recommended method for measuring the tarsus. Report measurements to the nearest 0.1 mm and make a note of which method was used.

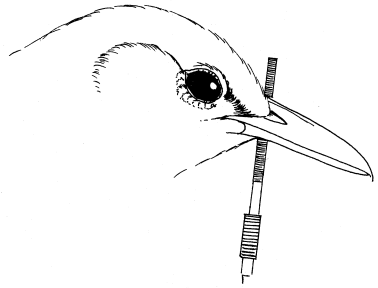


Fig. 6.5. Measuring bill width.

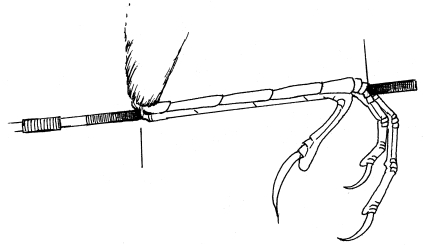


Fig. 6.6. Measuring tarsus length.

6.3.9 Toe length

Toes are measured on the upper side from the base of the claw (including the fine skin at the base of the claw) to the joint between the toe and the tarsus.

6.3.10 Claw measurement

Claws are measured on the upper side of the claw from the tip of the claw to the edge of the skin (Fig. 6.7).

6.3.11 Total head length

Total head length is also known as 'head+bill length' or 'overall head length' (Fig. 6.8). This is an accurate and reproducible measurement, which can be taken to 0.1 mm. Open the callipers wider than the expected head length, place the outer calliper at the back of the birds head and close the inner calliper until it just touches the beak point. The head can be gently rocked up and down to ensure that the maximum measurement is obtained. Callipers are best modified by fixing a butt to one end, against which the bird's skull is placed. Unbutted callipers can make it difficult to find the back of the bird's head. Care should be taken that the tip of the bill, which is flexible, is not pressed and a too short measurement is obtained.

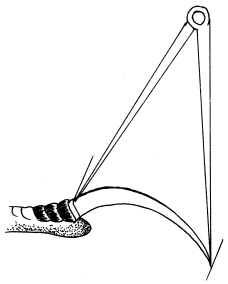


Fig. 6.7. Measuring claw length.

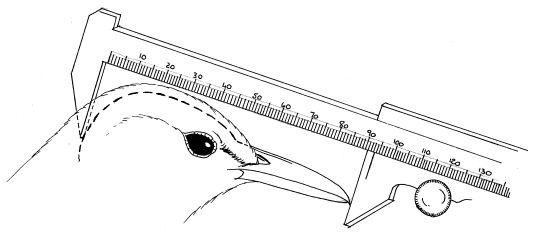


Fig. 6.8. Measuring head length.

6.3.12 Length

This measurement has poor repeatability and reproducibility and must cause some discomfort to the bird because the head is bent backwards into an unnatural position (not illustrated). This is not a recommended measurement, and is mentioned only for completeness. Put the bird with its back down on a stopped rule with the tail tip touching the stop. The bird is held by the legs and the tail is pushed down with the thumb. With the other hand hold the beak of the bird and stretch it very gently until the beak is approximately parallel to the rule whilst the crown of the bird rests against the rule. The measurement is taken to the nearest 1 mm.

6.3.13 Weighing birds

Birds can be weighed in a cone or in a bag. In the first case, the bird is placed in a tapering plastic cone. Two or three cones of suitable size will cover the normal range of birds. The advantages of the cone method are that it gently prevents the bird from moving, and the weight of the cone does not change. If a bag is used, it must be weighed immediately after each bird has been weighed, because the weight changes with use owing to excreta or moisture. Birds often move in the bag as they are being weighed; so it takes longer to get an accurate weight.

The type of balance used for determining weight is not important and a variety are available from beam- and spring balances to electronic top loaders. Most commonly used in South Africa are the spring balances, because of cost and ease of use.

Weight is the one measurement of birds that is subject to significant variation during the day, being lowest at dawn and highest at dusk; this is the other way around for nocturnal birds. The time of weighing therefore becomes important and should thus be recorded when every bird is weighed, using the 24-hour clock.

6.4 AGEING

The most valuable recovery information for birds ringed is for those that were ringed as nestlings because their exact age is known. In southern Africa, very few nestlings of the smaller and passerine birds are ringed and most birds in these groups are caught as free-flying birds, many as juveniles. Little work has been done on the ageing characteristics of smaller southern African birds up to now and a wide field lies open for any ringer who wants to explore and study this subject. There are several general characteristics to help with the determination of whether a bird is a juvenile or adult. Some of these characteristics are described below to assist the ringer in the identification of young birds. A bird should preferably be aged on several of these characteristics.

A complete list of the identification, ageing and sexing guides published in *Safring News* between 1972 and 1993 was compiled by L.G. Underhill (Underhill 1994).

6.4.1 Plumage

Juvenile plumage is often distinct and the birds can easily be identified by its features, e.g. much duller colours, mottled, spotted, striped or prominently barred. In these species the juveniles can be recognised until the first complete moult has taken place.

6.4.1.1 Body feathers

The juvenile body feathers in most species are weaker and more loosely textured than the following generation of feathers. This is especially so for the feathers of the neck, mantle and undertail coverts because they have hardly any interlocking barbules, and only a small area at the tip of the feather is relatively firm textured. These feathers have a soft and downy appearance.

6.4.1.2 Wing feathers

The juvenile primary coverts and remiges are often more pointed and narrower and in general shorter than the corresponding feathers of the later generation. This method should, however, be approached with care as there may be a considerable overlap between juvenile and adult feather shape. If two feather generations are present in the same feather tract, they may differ in shape and length which then will give a positive juvenile identification. The outermost short primary (P10) of juveniles of some species, on the other hand, may be both longer and wider than in adult birds.

6.4.1.3 Tail feathers

The tips of the feathers of a bird's first tail are often noticeably narrower and more pointed than those of adults. This is a structural character due to the fact that adult feathers have on average longer and denser barbs, making them wider and more glossy and making the tips rounder. A word of caution: birds that have been kept in bags or boxes might have had their tail shape altered considerably. This will make ageing with this method difficult or impossible.

6.4.1.4 Growth bars

Wing and tail feathers often have numerous bands of a different darkness, but not of a different colour across each feather, called growth bars. These growth bars are caused by structural differences and are developed as the feathers are growing. The growth bars can best be seen in reflecting light; hold the feathers at an angle of 45° to strong light. The distance between the bars and the width of each bar varies, depending on the growth rate of the feather and varying metabolic conditions.

Therefore if the growth bars on the tail all line up across the whole width of the tail and follow its shape, it is an indication that all the tail feathers grew simultaneously. This will always be the case for a bird's first tail feathers. One should, however, be careful because some birds moult all the tail feathers simultaneously as adults and this may cause errors. This can happen also to all other species in the case where the tail was lost accidentally. Do not use this technique in isolation but always combine it with one or more of the other techniques.

6.4.1.5 Wing coverts

The lesser and median wing coverts are often the last of the juvenile feathers to be moulted. Immature birds often have brown or buff tips to the lesser and median coverts.

This is sometimes affected by worn feather tips and in some species can look similar to those in adult birds. Care should therefore be exercised.

6.4.1.6 Underwing feathers

Immature birds usually grow their underwing coverts last and can be identified by pink bare skin over the wing bones and muscles long after fledging.

6.4.2 Post-juvenile moult

Most young passerine birds undergo a partial post-juvenile moult in the early part of their first year of life, usually during the period that their parents undergo a complete post-breeding moult. During a partial post-juvenile moult only the 'body feathers' are replaced, not the tail feathers or the flight feathers in the wing. Many species replace a number of coverts in the wing adjacent to the body during a partial post-juvenile moult, while the other coverts are retained from the juvenile plumage for the next year. In many cases the new feathers are different in colour, shape, length and structure or only structure compared to the juvenile feathers, and this creates a contrast between the inner series of renewed feathers and the outer series of old coverts (Fig. 6.9). This contrast is in some species barely visible and cannot be used for ageing (except perhaps after much experience) while it is so strikingly obvious in other species that it can be used as a character of age during observations in the field. In Europe, contrast features in the wing which result from a partial post-juvenile moult are currently the most widely used plumage criteria for the age determination of passerines (see Ginn & Melville 1983; Svensson 1992; Jenni & Winkler 1994).

A contrast between moulted and unmoulted juvenile feathers can be present within any series of the smaller feathers on the wing (greater, median or lesser coverts, carpal covert, alula feathers and tertials), and in a few species contrasts between different series can also be used, though cognisance needs to be taken of the fact that different series (e.g. greater coverts and primary coverts) may naturally have different colour and structure, even when all moulted (such as in adults). The contrast between moulted and retained juvenile feathers is usually most easily detected in the greater coverts. Clearly,

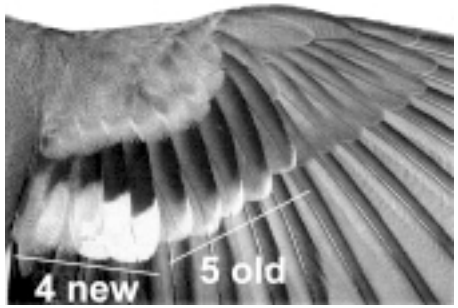


Fig. 6.9. Contrast in wing coverts. Taken from Herremans (1995).

juvenile birds of any species which renewed all coverts in the wing cannot be distinguished from adults any more on the presence of a plumage contrast in the wing.

In order to use feather contrasts from the post-juvenile moult correctly, it is essential that the moult cycles of the species involved are known. Basic moult sequences in southern African birds are incompletely documented (e.g. review by Craig 1983), but it can be assumed that, except for some larks, bulbuls, starlings, sunbirds, weavers and waxbills (which undergo a complete post-juvenile moult), most southern African passerines undergo only a partial post-juvenile moult. In species with a reasonably well-defined local breeding season, any bird caught after the breeding season and up to the end of the next winter with clear contrasts in the wing coverts between a new inner series and an older outer series can be assumed to be a juvenile bird which underwent a partial moult.

With the arrival of spring, matters are more difficult. In species known not to undergo a moult just prior to breeding, the method is reliable in principle. However, with increasing time since the post-juvenile moult, feather wear may start to obscure the contrast between 'old' and 'new'. For species which develop a breeding plumage during a partial pre-breeding moult, wing-feather contrasts can no longer be used for ageing during the period between the spring moult and the post-breeding moult, because most of the contrasts seen in that period may well result from the partial pre-breeding moult, which all birds irrespective of age undergo more or less in the same way.

The method of ageing on wing-feather contrast is likely to apply to a variety of species in southern Africa, particularly in the groups of thrushes, tits, warblers, flycatchers, wagtails, shrikes, finches, buntings and canaries; it was found useful in 23 species in Botswana (Herremans 1995).

6.4.3 Gape flange

The gape flange of juvenile birds is usually thick, swollen and conspicuously coloured (white, yellow, etc). This thick swollen gape disappears rather quickly after fledging and is therefore only reliable for a short period of time. There are, of course, exceptions; in some of the weavers, the gape changes slowly over a long period of time. Adults of some species always show a gape flange; examples are the Greyheaded Sparrow and Redheaded Finch, but these are not as puffy as for juvenile birds. Once again care should be exercised when ageing a bird on the gape flange.

6.4.4 Palate colour

The palate colour of juvenile birds often differs in colour from that of the adult bird.

6.4.5 Bill colour

The bill colour of young birds often differs from that of adults by being paler, brown or even black. This is especially so in many species with bright-coloured bills. The bill colour of many birds changes with age; usually it becomes brighter and more intense. In some species the bill colour becomes paler after the breeding season and confusion between adults and young birds can occur.

6.4.6 Eye colour

The eye colour (iris) may differ between young birds and adults; in young birds the eye is usually duller. The young birds usually have a dark eye (iris); dark grey, olive grey and dark brown are the common colours. With ageing the colours can become lighter or warmer.

6.4.7 Feet and legs

The feet and legs of immature birds usually have a soft texture and a slightly fleshy and swollen appearance, while the legs of adult birds are usually hard textured and slightly thinner. Immature and young birds may have a different leg colour to that of adults, usually being paler. Once again practice and knowledge are very important in this technique.

6.4.8 Other methods

There are still other methods available for ageing birds, e.g. beak shape, skull ossification and tongue spots, but these are difficult techniques in the sense that they need a lot of experience and practice. Although they are reliable, one needs a lot of data to be able to use these techniques with confidence.

6.5 DETERMINATION OF SEX

6.5.1 Plumage

To be able to determine the sex of a bird adds a considerable amount of value to the information collected from them. The most frequently used method for determining the sex of a bird is the variation in plumage patterns between male and female.

6.5.2 Measurements

Sexual dimorphism among birds is a well-known phenomenon which includes differences in size of male and female for many species. In passerines, it is normally the male that is larger than the female. In birds of prey and in waders, this is normally reversed and the male is smaller than the female. It is therefore sometimes possible to use measurement data to sex species fairly reliably for which there are no plumage differences between males and females. There will always be an element of uncertainty when using this method. If the measurements of the males and females have little overlap, and a large amount of data are available, the uncertainty might be small.

When possible do not rely solely on measurements. This is because measurement techniques may differ, geographical size variation may occur, worn plumage may give false measurements, and there is usually some overlap so that birds of one sex fall into the ranges given for the other sex. When using this method, it is recommended that all relevant measurements be taken and the bird be assigned to a sex based on the full range of measurements.

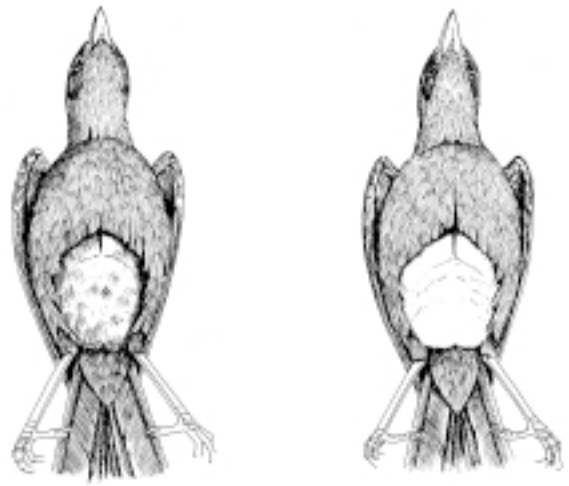


Fig. 6.10. Brood patch beginning to develop; distinct brood patch.

6.5.3 Incubation patch

An incubation or brood patch is developed by many birds just before the actual incubation starts. This is a patch on the ventral surface where all or nearly all the down feathers are dropped, creating a bare patch where the skin becomes thicker and frequently wrinkled, with the blood vessels increasing in size and number (Fig. 6.10). A well-developed incubation patch is completely naked, or nearly so, with a pink to red colour. The incubation patch helps to increase the efficiency of the heat transfer from the body to the eggs. Not all birds develop an incubation patch, e.g. ducks. In those birds where both sexes incubate, both may develop a brood patch; while in the species where only the one sex incubates, only that sex may develop one. Some birds will only develop a semi-patch and this is especially so for many male birds. As a rule in passerine birds, the incubation patch is developed only in females and is thus uncommon in males.

After incubation the patch slowly returns to normal. During this retrogression process the skin often becomes wrinkled and scaly with a yellowish appearance. The feathers, however, do not grow until the autumn moult. In the species that are double brooded (or more) the process repeats itself again before each incubation.

The incubation patch is a useful method for sexing birds during the breeding season provided that utmost care is taken, as mistakes can easily be made. In southern Africa, little has been published on the reliability of the incubation patch for sexing different species of birds.

6.5.4 Cloacal shape

In many species of passerine birds it is possible to determine the sex of the bird by the characteristic shape of the external sexual parts, because these become enlarged during

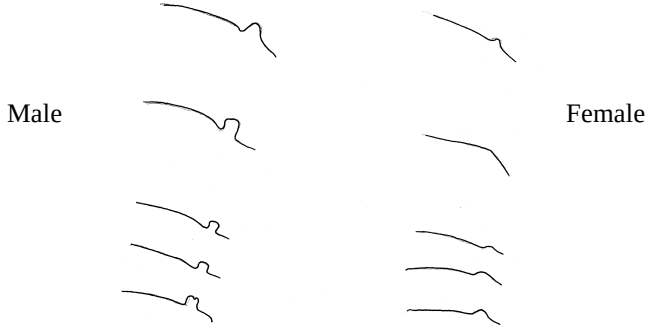


Fig. 6.11. Variation in cloacal shape in male and female birds.

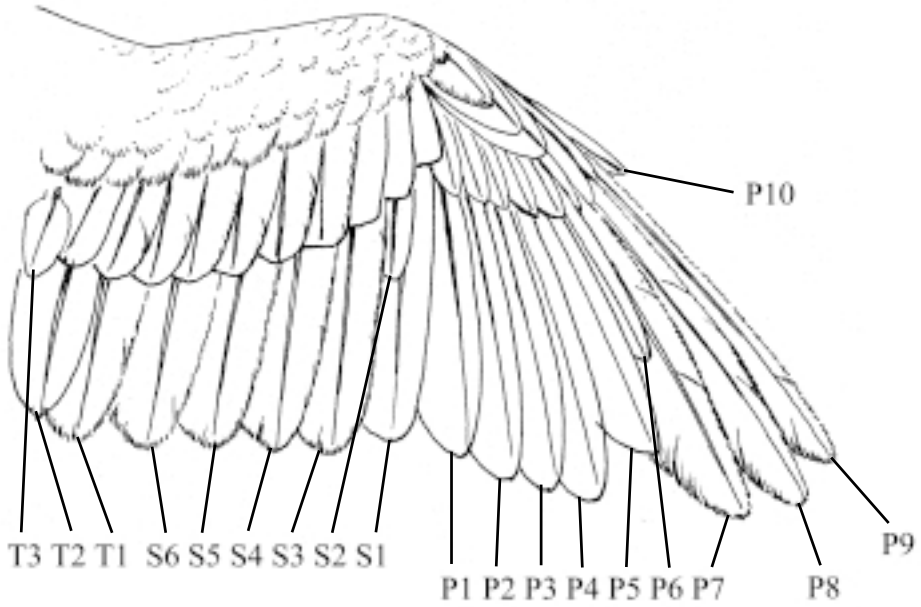
the breeding season. This method is useful where the different sexes look alike. When fully enlarged, there is usually a clearly discernible difference in cloacal shape between males and females (Fig. 6.11). In the male the cloaca points upwards or forwards (parallel sided) and will usually show a fold between the front of the cloaca and the abdomen. The female cloaca usually points backwards (sloping sides) and shows no fold or crease. Although the cloacal shape can be used as a sexing technique on its own, it is always better if it can be used in conjunction with another technique, for instance the incubation patch. Outside the breeding season the reliability of this method has not yet been proven. When one examines the cloaca, the feathers should only be blown apart to expose it: do not wet the feathers or use your fingers. Examining the cloaca of birds of known sex is a good way to gain experience in this technique.

6.5.5 Other techniques for sexing birds

More techniques exist, but these are not recommended for ringers. The internal cloacal examination, used mainly for ducks but also used for passerines by some workers, is a method not recommended at all by Svensson (1992). Another technique is laparotomy where the bird's gonads are examined by making an opening in the abdomen. This procedure should only be performed by researchers who have been specifically trained to use it.

6.6 MOULT

Apart from the fact that feathers are a unique feature of birds, distinguishing them from all other forms of life, they also play an important role in the bird's existence. Feathers form the outside light-weight protective barrier against impact, solar radiation and water and contribute to the bird's aerodynamic shape. Feathers are also responsible for the thermal insulation and thus play an important role in the thermal regulation. Last but not least, they are also responsible for the bird's appearance, and in many species are used to communicate breeding status and quality. The feathers need to be kept in a good condition. This is achieved by the bird by daily care in the form of preening, dust



Tertials			Secondaries						Primaries									
T3	**T2**	**T1**	**S6**	**S5**	**S4**	**S3**	**S2**	**S1**	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**
2	5	0	0	0	0	0	2	5	5	5	5	5	4	3	0	0	0	X

Fig. 6.12. Scoring moult in primary, secondary and tertial wing feathers.

bathing and sunbathing. Even with all the care taken by the bird, the condition of the feathers still deteriorates owing to abrasion, exposure to the elements and ultraviolet light. With the deterioration the feathers also lose their sheen and colours tend to fade.

Because of this deterioration feathers have to be replaced regularly, and this natural replacement of feathers is known as moult. In most species moult takes place once a year, although in some species, such as the Willow Warbler, the flight feathers are replaced twice per year. In the larger species, such as the larger birds of prey, it occurs only once in two to three years with feather growth continuing over the whole period. Ducks and geese moult their primaries and secondaries simultaneously and thus become flightless for about a month every year.

Moult information is essential to understanding how birds have adapted to their often difficult and variable environment. The annual cycle of a bird cannot be understood properly without knowledge of its moult strategy. Moult studies have also become very important in the ageing of birds and can also be helpful when identifying species and subspecies.

The study of moult can be undertaken without the ringing of birds. Doing the two together, however, is sensible as birds are already being handled when ringing. This also has the advantage that birds can be recaptured and moult progress can be measured. Ringers should therefore participate in the SAFRING moult scheme if at all possible. With a little training and practice the writing up of basic moult can be mastered by anybody.

The aim of this section is to provide ringers with the basic knowledge to fill in a SAFRING moult card. A prerequisite for being able to fill in moult cards is being familiar with the different feather tracts that are examined during the moult determination as well as the codes used for feathers in various stages of growth (Fig. 6.12). These codes are:

0 = old feather remaining
1 = feather missing or new feather in pin
2 = feather emerging from sheath up to $^1/_3$ grown
3 = new feather between $^1/_3$ and $^2/_3$ grown
4 = new feather from $^2/_3$ to fully grown but with remains of waxy sheath persisting
5 = new feather fully developed with no trace of sheath remaining at base
8 = full-grown feather of uncertain age

This gives a numerical scoring system to indicate the progress of moult. For example, in a bird with ten primaries the primary moult score before moult starts will be zero (10×0). At the end of moult, when all the primaries are new and full grown (5) the score will be 50 (10×5) for each wing.

When checking moult of the wing, one should not just count the primaries from the outermost feather inward until the right number of primaries have been counted and then assume that the last feather counted is the inner primary. Missing feathers or feathers in the early stages of growth are sometimes very difficult to see and can be missed easily; a check should therefore be built in. In many species the primaries differ in shape or colour pattern from the secondaries, with the primaries usually more pointed than the secondaries. The secondaries are more square, or rounder and less pointed at the tip with shafts that tend to curve towards the body. If the wing is gently opened and closed, the division will usually become clearer, as the primaries move as a unit and the outermost secondaries pivot over the innermost primaries. To confirm the correctness of the diagnosis, count both the primaries and secondaries to see that the correct number of feathers can be accounted for.

Old feathers can usually be recognised by their worn and faded appearance. The tips of the old feathers will be abraded and ragged, while new feathers usually have smooth and uniform tips with warm and rich colours.

The following feather tracts are considered as a whole and not as individual feathers; the codes used for these tracts are printed next to the boxes on the moult card:

- ❑ lesser and median coverts
- ❑ underwing coverts
- ❑ head
- ❑ upperparts
- ❑ underparts

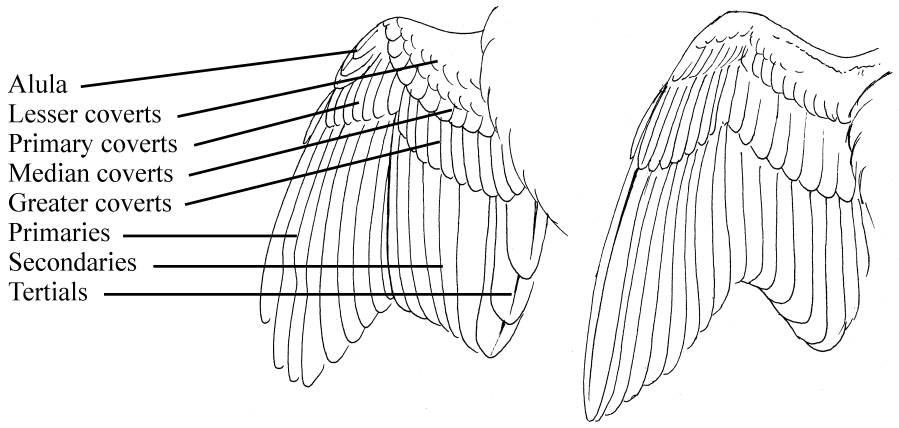


Fig. 6.13. Upperwing and underwing of a bird.

The purpose of this writing is not to give a complete overview of the moult process but only to give the basic background. It is recommended that anybody who wants more information and detail on moult should refer to Ginn & Melville (1983) or Jenni & Winkler (1994).

6.6.1 Primaries

The primaries are the flight feathers on the outer part of the wing; anatomically, these are attached to the metacarpus and the digits. This is the part of the skeleton that would be equivalent to the human hand. Primaries 1 to 6 are attached to the metacarpus whilst primaries 7 to 10 are attached to the digits, P7 to the third digit, P8–9 to the first phalange of the second digit and P10 to the second phalange of the second digit. In flying birds the number of primaries varies between nine and eleven. All passerines have ten primaries although in many species the tenth primary is much reduced or even vestigial.

In southern Africa, the following three categories are mainly found for passerine birds:

- **Ten primaries present, P10 present, markedly shorter than P9 but easily found:** drongos, orioles, crows, tits, tree-creepers, babblers, cuckooshrikes, bulbuls, thrushes (including chats and robins, etc.), warblers, flycatchers, shrikes, bush shrikes, helmetshrikes and sunbirds.
- **Ten primaries present, P10 vestigal and usually only to be found by careful search**: larks, starlings, weavers (including sparrows, bishops and waxbills).
- **Nine primaries present, P9 well developed or even the longest:** swallows, wagtails (including pipits and longclaws), white-eyes, canaries and buntings.

In the non-passerines all families have ten primaries with the exception of the honeyguides which have only nine primaries and the grebes and storks which have eleven primaries.

The number of primaries rarely differs within a species. However, in species which have the outer primary much reduced, this primary sometimes grows to nearly the same length as the other primaries. Very occasionally, birds have one more or one less primary than normal for the species; this can occur either in one or in both wings. Although rare, ringers should always be on the lookout for such anomalies. In modern moult studies, the primaries are always numbered descendantly; that is from the carpal joint outwards from the body. In most species, the moult progresses descendantly through the primaries, so that the numbering of the primaries coincides with the order of moult. When reading old literature on primary moult, if it does not appear to make sense, it is likely that the author numbered the primaries ascendantly, from the outside inwards. The Pied Flycatcher is the only species occurring in southern Africa that is known to moult ascendantly.

Moult of the primaries usually starts with P1 (occasionally with P2 or P3) and proceeds descendantly towards P10. Primary moult usually extends over the entire moult period for all feather tracts, and can therefore be taken as a reference for moult progress in the other feather tracts. Because P10 is usually small, it is often fully grown before P8 and P9. Usually moult proceeds symmetrically in both wings.

6.6.2 Secondaries

The flight feathers that are attached to the ulna (this is the equivalent of the human forearm) are called the secondaries . The secondaries are numbered ascendantly from the carpal joint towards the body. The secondaries vary in number between species; in passerines this is normally nine with a few species having ten or eleven secondaries. In the non-passerines the number seems to be related to the length of the ulna or forearm. Woodpeckers have eleven secondaries; vultures have between 18 and 25 and the Wandering Albatross has 32 secondaries.

Moult of the secondaries usually starts with S1 and proceeds ascendantly towards the body. The numbering of the secondaries is in the general order in which they are replaced. Secondary moult usually starts at about the same time as P5 is moulted; the last flight feathers to complete moult are usually S5 and S6.

6.6.3 Tertials

The inner three secondaries normally differ in shape, size and colour from the six outer secondaries and normally they also have a different moult sequence. The tertials should not be considered separately from the secondaries because, if we do so, we will be completely lost if we make comparisons with species in which these feathers do not differ morphologically. Therefore it is better to consider all the feathers attached to the ulna as secondaries. The tertials, however, have their own moult sequence which is usually in the order of TO, T9 and T7; however, this order can be fairly erratic and can either start with T7 or T9. On average the tertial moult starts when P4 is in growth and is completed by the time P8 and P9 are growing.

6.6.4 Alula or bastard wing

On the upper leading edge of the wing attached to the pollex (equivalent to the human thumb) is a group of feathers called the alula or bastard wing. Normally the feathers of

the alula number three but there may be as few as two or as many as seven feathers. The relative length of the alula feathers varies, with the distal feather being the longest. The alula feathers are numbered from the innermost to the outermost, that is, from the shortest to the longest. This is also the moult sequence. Moult of the alula normally starts when P5 and P6 are growing and the feathers are rated individually.

6.6.5 Greater and primary coverts

The base of each wing feather (remex) on the upperwing is covered with a smaller feather called a covert, each secondary is covered by a greater covert (GC) and each primary by a primary covert (PC). Moult of the primary coverts is not addressed on the SAFRING moult card and is thus not usually done. The moult of the greater coverts starts soon after primary moult has begun and is usually completed by the time that the secondary moult starts. In general, the greater coverts moult simultaneously but there is great variation in moult patterns.

6.6.6 Carpal covert

In some species of birds (gulls and fowls) there is an extra remex between the innermost primary and outermost secondary, namely the carpal remex with its own covert called the carpal covert (CC). In other species it may be very small and lack a carpal covert, for example, the woodpeckers. In the passerines the carpal remex is absent but the carpal covert is present. The carpal covert usually moults in sequence with the greater coverts and is considered a part of that tract.

6.6.7 Median and lesser coverts

Above the greater coverts there are eight or nine median coverts and several rows of lesser coverts. These feather tracts are considered as one on the moult card and the feathers are not looked at individually but as a whole: an average assessment is thus filled in.

6.6.8 Underwing coverts

The greater and median underwing coverts are those feathers that cover the base of the remiges of the underwing. These feathers are also considered collectively and an average moult is reported for these. Moult of the underwing coverts usually starts during the second half of the primary moult.

6.6.9 Rectrices

The flight feathers of the tail are called rectrices. The number of rectrices vary more than the wing feathers do. The rectrices occur in even numbers and are usually numbered in pairs from the centre outward (centrifugally). The number of rectrices varies greatly between species and may comprise as few as four or as many as 30. Most of the passerines have twelve rectrices; an exception to this is the prinias which have ten rectrices. Moult of the rectrices usually starts with R1 and proceeds centrifugally in pairs. Although centrifugally is the common sequence, this can also be very erratic and

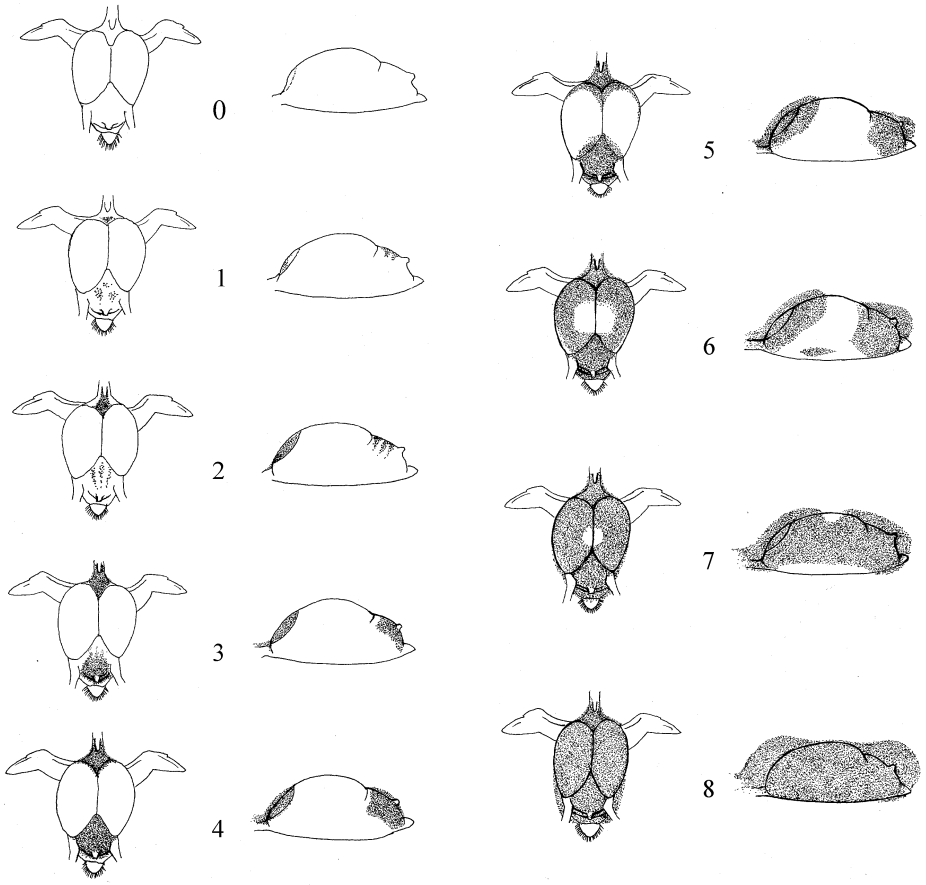


Fig. 6.14. Fat-score stages in birds: fat classes 0 to 8; fat = stippled areas.

moult can start anywhere among the rectrices. A common phenomenon, especially amongst the Palaearctic warblers, is that all the tail feathers moult simultaneously. Rectrice moult starts approximately when P4 is growing and is completed by the time that P8 and P9 are growing.

6.6.10 Body feathers

The body feathers are the small contour feathers that cover most of the body of the bird; for moult recording purposes these are divided into head, upperparts and underparts. Moult is assessed as a whole for each of the three areas and an average moult is reported in the specific box on the form. Body and head moult normally starts after the beginning of primary moult and is completed soon after primary moult is completed. The feathers on the head are normally moulted last.

6.7 SKULL OSSIFICATION (SKULL PNEUMATISATION)

Passerines are characterised by having a double-layered skull with air between the layers. Young passerine birds leave the nest before the skull roof bone is completely grown and when it still consists of a single layer of bone. A second layer of bone is formed under the original skull bone layer, and the layers are connected by tiny bone pillars keeping the layers apart. This second bone layer starts growing from the back of the head towards the forehead and normally follows a fixed pattern, either a general pattern or, in certain families, more specialised patterns. The progress of the skull growth (pattern) can be used for aging young birds. Good books are available for the serious ringer and can be read for detailed information on this subject. Two recommended books are:

- **Identification Guide to European Passerines** by Lars Svensson.
- **Moult and Ageing of European Passerines** by Lukas Jenni and Raffael Winkler.

6.8 FAT SCORE

The measurement of the fat score of birds is relatively unknown in southern Africa although it was introduced in Europe some years ago. The method was standardised with the introduction of the fat-score classification as developed by Kaiser. With southern African participation in international projects, there is a need to become familiar with Kaiser's fat scoring method. This technique is easy to master: it needs a demonstration and some experience.

Subcutaneous fat deposits of birds can be estimated visually. Kaiser developed a method where the fat score is rated on a nine-point scale from 0 to 8. On this scale there are nine main fat-score classes; these were adopted by the European–African Songbird Migration Network in its *Manual of Field Methods* (Fig. 6.14). When determining the fat class, look at the two most important regions for fat deposits: the furcular region or tracheal pit and the abdomen. The bird must be positioned correctly before the determination can be made. Lie the bird on its back in the one hand and hold the legs with the other hand. Stretch the neck slightly so that the furcular fat deposit becomes prominent; now blow the feathers of the furculum and abdomen apart. Determine the fat score by comparing with Kaiser's diagram. Because the skin is semi-translucent, a bright light helps to give a better contrast between yellowish fat layers and reddish muscle tissue.

7

Collecting bird parasites

7.1 INTRODUCTION

The study of parasites of wild birds is a neglected field of zoological study in South Africa. Our knowledge of many of the bird parasites is limited to scientific names and we have little information on their biology, distribution or general life history. A better knowledge of bird parasites will increase our understanding of both the life history of the parasite as well as that of the bird. For example, the relationship between parasites might provide important clues to relationships between various groups of birds. Furthermore, a thorough understanding of the occurrence and host-specificity of bird parasites might shed light on the transmission and spread of disease, important to both man and animals. Bird ringers can make a significant contribution to the study of bird parasites by collecting these parasites when handling birds.

7.2 TYPES OF PARASITES

There are two types of bird parasites: ectoparasites and endoparasites. The ectoparasites live on the surface of the host while endoparasites live inside the host body. Blood parasites are endoparasites but they require special collection methods and are too small to be seen by the human eye.

The ectoparasites of birds are arthropods and include various insects, ticks and mites. These arthropods can either live in close contact with the host's body where they feed on blood, body fluid or the feathers (body parasites) or they can spend most of their lives in the nest or roosting place of the host. They are thus not carried around by the host but only get onto it sporadically to feed (nest parasites). Ringers seriously interested in helping with the collection of bird parasites should contact SAFRING.

8

The bird ringer and the law

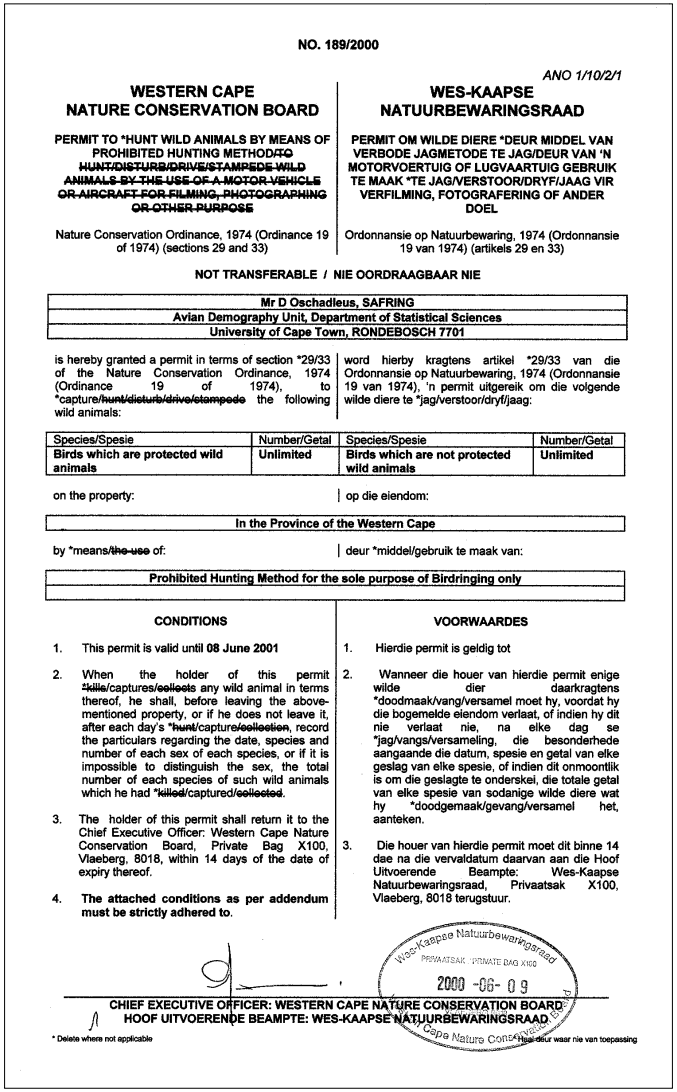
In terms of the constitution of South Africa, nature conservation is a provincial responsibility. The laws pertaining to the protection of plant and animal life are promulgated in provincial ordinances. Although the terms of such ordinances and the levels of protection offered to the different species may vary from province to province, most ordinances have certain clauses in common and these will generally prescribe prohibited methods and times of hunting and capturing protected fauna. The legal definition of 'to kill' is broad and usually includes 'to hunt, pursue, capture, wilfully disturb or lie in wait for'. These clauses and definitions ensure that any practising bird ringer is in contravention of the law unless he is in possession of a valid permit issued by the relevant provincial authority.

A permit may specifically authorise the permit holder to capture, ring and release listed species of birds in specified districts, or it may merely exempt the holder from certain provisions of the ordinance. Permits are normally valid for 12 months from the date of issue and have to be renewed annually. The onus is on the permit holder to apply for renewal; reminders are not sent out. Note that permits are issued free of charge, whereas licences have to be paid for. Because bird ringers do not remove wildlife permanently from the environment (as fisherman do, for example), it is appropriate that they should not have to pay licence fees. However, it is ultimately the prerogative of the provincial authority to decide which activities will be authorised by permit and which by licence.

A permit does not entitle the holder to operate on private property. Some permits explicitly state that the holder should obtain written permission from landowners on whose property the authority of the permit is to be exercised. Whether the permit makes this a condition of issue or not, it is wise to seek such written permission of the owner of ringing sites on private land. Permits (and copies of written permission to enter and ring on private land) should be carried at every ringing operation. You never know when a member of the public will complain to the police about your activity in the mistaken belief that you are up to no good, and it will save valuable time if the provincial ringing permit and other documents can be produced to prove that your activity is legal.

A provincial permit is only valid in the province of issue, so if a ringer chooses to ring in more than one province, then more than one permit needs to be obtained. All permits should be returned timeously, either before or upon expiry date, together with any lists of birds ringed if this is a requirement listed as a condition of issue.

Ringers should be aware that, in terms of the provisions of nature conservation ordinances, they are given very special privileges when authorised to ring wild birds.



NO. 189/2000

ANO 1/10/2/1

WESTERN CAPE NATURE CONSERVATION BOARD

PERMIT TO *HUNT WILD ANIMALS BY MEANS OF PROHIBITED HUNTING METHOD~~/TO HUNT/DISTURB/DRIVE/STAMPEDE WILD ANIMALS BY THE USE OF A MOTOR VEHICLE OR AIRCRAFT FOR FILMING, PHOTOGRAPHING OR OTHER PURPOSE~~

Nature Conservation Ordinance, 1974 (Ordinance 19 of 1974) (sections 29 and 33)

WES-KAAPSE NATUURBEWARINGSRAAD

PERMIT OM WILDE DIERE *DEUR MIDDEL VAN VERBODE JAGMETODE TE JAG/DEUR VAN 'N MOTORVOERTUIG OF LUGVAARTUIG GEBRUIK TE MAAK *TE JAG/VERSTOOR/DRYF/JAAG VIR VERFILMING, FOTOGRAFERING OF ANDER DOEL

Ordonnansie op Natuurbewaring, 1974 (Ordonnansie 19 van 1974) (artikels 29 en 33)

NOT TRANSFERABLE / NIE OORDRAAGBAAR NIE

Mr D Oschadleus, SAFRING
Avian Demography Unit, Department of Statistical Sciences
University of Cape Town, RONDEBOSCH 7701

is hereby granted a permit in terms of section *29/33 of the Nature Conservation Ordinance, 1974 (Ordinance 19 of 1974), to *capture/~~hunt/disturb/drive/stampede~~ the following wild animals:

word hierby kragtens artikel *29/33 van die Ordonnansie op Natuurbewaring, 1974 (Ordonnansie 19 van 1974), 'n permit uitgereik om die volgende wilde diere te *jag/verstoor/dryf/jaag:

Species/Spesie	Number/Getal	Species/Spesie	Number/Getal
Birds which are protected wild animals	**Unlimited**	**Birds which are not protected wild animals**	**Unlimited**

on the property: | op die eiendom:

In the Province of the Western Cape

by *means/~~the use~~ of: | deur *middel/gebruik te maak van:

Prohibited Hunting Method for the sole purpose of Birdringing only

CONDITIONS

1. This permit is valid until **08 June 2001**
2. When the holder of this permit ~~*kills~~/captures/~~collects~~ any wild animal in terms thereof, he shall, before leaving the above-mentioned property, or if he does not leave it, after each day's *~~hunt~~/capture/~~collection~~, record the particulars regarding the date, species and number of each sex of each species, or if it is impossible to distinguish the sex, the total number of each species of such wild animals which he had *~~killed~~/captured/~~collected~~.
3. The holder of this permit shall return it to the Chief Executive Officer: Western Cape Nature Conservation Board, Private Bag X100, Vlaeberg, 8018, within 14 days of the date of expiry thereof.
4. **The attached conditions as per addendum must be strictly adhered to.**

VOORWAARDES

1. Hierdie permit is geldig tot
2. Wanneer die houer van hierdie permit enige wilde dier daarkragtens *doodmaak/vang/versamel moet hy, voordat hy die bogemelde eiendom verlaat, of indien hy dit nie verlaat nie, na elke dag se *jag/vangs/versameling, die besonderhede aangaande die datum, spesie en getal van elke geslag van elke spesie, of indien dit onmoontlik is om die geslagte te onderskei, die totale getal van elke spesie van sodanige wilde diere wat hy *doodgemaak/gevang/versamel het, aanteken.
3. Die houer van hierdie permit moet dit binne 14 dae na die vervaldatum daarvan aan die Hoof Uitvoerende Beampte: Wes-Kaapse Natuurbewaringsraad, Privaatsak X100, Vlaeberg, 8018 terugstuur.

Wes-Kaapse Natuurbewaringsraad PRIVAATSAK / PRIVATE BAG X100 2000 -06- 09 Cape Nature Conservation Board

CHIEF EXECUTIVE OFFICER: WESTERN CAPE NATURE CONSERVATION BOARD
HOOF UITVOERENDE BEAMPTE: WES-KAAPSE NATUURBEWARINGSRAAD

* Delete where not applicable — *Skrap deur waar nie van toepassing

Fig. 8.1. Example of a ringer's permit.

Every ringer ought to abide strictly by the legal requirements; failure to do so will give bird ringing a bad name with the authorities, and will result in far less cooperation from them than we currently receive.

For countries outside South Africa, the relevant authority needs to be contacted. In Botswana, for instance, a new ringer must obtain permission from the Office of the President (Private Bag 001, Gaborone) and must first submit to the Office a research proposal which meets the research priorities of the Department of Wildlife & National Parks.

9

Ringing administration

9.1 KEEPING RECORDS

The job is not finished until the paperwork is done! The ringing of birds will have no purpose unless accurate records are carefully kept and updated after each ringing session. What records should a ringer keep? The measurements required by SAFRING are the mass of the bird, wing length and primary moult. But keep it in mind that there is nothing as frustrating as when, after a number of years of ringing, you want to do a study or project on a specific species and you discover that you ringed hundreds of them but you have no data or measurements written down. Therefore it is advisable to collect as many data as possible.

9.2 FIELD RECORDS

Each ringer has his/her own way of recording his/her data collected. Some like to write all birds caught and ringed on a specific day in a file or book in sequential order, and then transfer the data to another file according to ring series when they get home. These days most ringers prefer to have schedules ready with the ring numbers pre-recorded in series of 50 rings (Appendix 5). For each different ring series a schedule is kept in a file and when full it may be transferred to another file kept for completed ring series.

The following are the more common details that are recorded:

Obligatory items

- ❑ **Ring number:** prefix and number of ring.
- ❑ **Species number:** number given in the ring-size guide (old Roberts number).
- ❑ **Date:** in Day/Month/Year.
- ❑ **Locality:** place name, nearest town and district.
- ❑ **Coordinates:** determined by a GPS or from a map (degrees and minutes).

Recommended items

- ❑ **Mass:** weight of bird in grams, suggesting the following:
  - ✧ 0–50 g scale to the nearest 0.2 g.
  - ✧ 0–100 g scale to the nearest 0.5 g.
  - ✧ >100 g scales to the nearest 1 g except for the large scales (5 g and 10 g units).

- ❑ **Wing length:** wing length in mm, using the 'maximum chord' method.
- ❑ **Primary moult:** score each primary (e.g. 5554310000).

Optional items

- ❑ **Species name:** bird name as given in ring-size guide (Appendix 9).
- ❑ **Tail length:** tail length in mm.
- ❑ **Tarsus:** length of tarsus in mm to the nearest 0.1 mm.
- ❑ **Culmen length:** length of bill to the nearest 0.1 mm.
- ❑ **Head length:** total head length to the nearest 0.1 mm.
- ❑ **Time:** use the 24-hour clock, e.g. 13h25 or 1325.
- ❑ **Notes:** for any additional information, e.g. Bird has only one leg or laid egg in bag, etc.

The above is just an example of what data a ringer may want to collect. He can add other data, e.g. colours for various soft parts.

9.3 SAFRING ELECTRONIC SCHEDULES

The SAFRING ringing year runs from 1 July of the one year to 30 June the following year. Schedules must be submitted electronically or on SAFRING Schedule 1 forms. These should be submitted at regular intervals, e.g. monthly. On 30 June every year all outstanding ringing records must be submitted for the ringing year totals to be calculated. Paper schedules make provision for 50 rings and it is suggested that schedules are completed and forwarded to SAFRING as soon as they are completed; this reduces the end-of-year rush both for the ringer and at SAFRING. Similar principles apply to the submission of electronic schedules. Remember SAFRING can and will withhold the supply of equipment and rings if schedules are not submitted at least annually and in good time.

9.3.1 Format of electronic data

Summaries and initial details (i.e. total rings used and dates of first/last rings), which were part of the Schedule 1 form, should be excluded.

Each column or field is discussed in detail below. The fields are listed in bold in the sequence in which they must be submitted.

- ❑ **Ring** – each record must have a complete ring number, not just the last two digits. The format of the ring number should have no hyphens, blanks or other characters, i.e. the prefix and number should be continuous: e.g. 456001 rather than 4-56001, and BC23001 rather than BC 23001.
- ❑ **Code** – this is to distinguish recaptures and controls from newly ringed birds. Use the following codes:

  1: Newly ringed bird
  2: Recapture/Control/Resighting
  L: Lost ring
  X: Ring recovery

In the past only recaptures of over one year needed to be submitted to SAFRING (on the Schedule 2 or 3 forms). Now all recaptures (after the date of ringing) may be submitted. Recoveries can be included in your database in the same way as recaptures. Note

that additional details should be submitted to SAFRING, i.e. details on the condition of the bird (fresh, decomposing, etc.) and how the bird died, etc. For resightings state the colour combinations seen in an extra column.

- **Date** – Enter the date: dd mm yyyy.
- **Species** – continue using the SAFRING numbers (similar to the old Roberts number). SAFRING can e-mail a list of species names with Roberts numbers to any ringers who would like it. Species not listed in the old Roberts have been assigned numbers by SAFRING (see Appendix 9). If you ring a bird where you do not know the number, contact SAFRING to get the number before submitting the data.
- **Ringer** – Each ring record must have your ringer's number. For those who have more than one number (for different provinces), only use your current number (i.e. for where you are living now). Use your current number for all ringing, no matter where the ringing occurs.
- **Age** – unchanged, i.e.

0 = Age unknown	**5** = 0 to ½ year
1 = Pullus	**6** = ½ to 1 year
2 = Juvenile	**7** = 1 to 2 years
3 = Immature	**8** = 2 to 3 years
4 = Adult	**9** = Older

- **Sex** – unchanged, i.e.

0 = Sex unknown.	
1 = Male	**3** = Possible male
2 = Female	**4** = Possible female

- **Marking** – unchanged (but with some additions), i.e.

0 = Metal ring only	**6** = Colour dyes
1 = Colour ring	**7** = Dyes and colour ring
2 = Wing tag	**8** = Radio/transponder
3 = Nasal saddle	**9** = Satellite
4 = Collar	**10** = Canadian (colour ring with inscription)
5 = Harness	

- **Condition** – unchanged, i.e.

0 = No other code required	
6 = Rehabilitated	**8** = Released away from place of capture
7 = Artificially reared	**9** = Oiled and cleaned

- **Coords** – the coordinates must be obtained from a GPS or maps. Coordinates obtained from a GPS must be truncated to the nearest minute when submitted to SAFRING. The format should be 2345S 1828E. There must be one space after the S. You must use the letters S and E, since the gazetteer references the field exactly as written.
- **Locality** – use up to 25 characters here to describe the location. Be consistent in naming localities, and in using the same name every time you ring at the same site. The name should ideally describe the entire minute-by-minute grid cell, because the SAFRING gazetteer uses one name per set of coordinates.

- **Province** – use the new province designations as listed below (make sure you know in which province the locality falls). Note the capitals for SA provinces and lower case for countries.

WC	Western Cape
MP	Mpumalanga
GP	Gauteng
EC	Eastern Cape
KZ	KwaZulu-Natal
FS	Free State
NC	Northern Cape
NP	Northern Province
NW	North West Province
bw	Botswana
ls	Lesotho
mw	Malawi
mz	Mozambique
na	Namibia
sz	Swaziland
zm	Zambia
zw	Zimbabwe

- **YrR** – the ringing year (e.g. 1999 for 1 July 1999 to 30 June 2000).
- **Mass** – mass of bird in grams, as on Schedule 1 forms. For large birds of several kilograms you still need to give the mass in grams and not in kilograms.
- **Wing** – length of wing in mm, flattened wing chord.
- **Moult** – primary moult, each feather from P1 to P10 in one string, e.g. 5555543100, or 555554310 if P10 is reduced or absent.
- **Colour rings** – add one column if you use colour rings. Use this format: red/light green/blue, black/red/metal. Left leg, with rings from top to bottom, comma, right leg with rings from top.
- **Sent** – a field for your own reference. When you have sent records to SAFRING, mark this field (e.g. with the date of sending) so that you do not send the same data again. Do not send this field to SAFRING.

9.3.2 Additional fields

You may have additional fields for other measurements or notes. Do not send these to SAFRING at this stage.

9.3.3 Software and suggested method

Use Microsoft Excel for Windows 95 or check with SAFRING if you have other software.

1. Put your Ringing tables on separate pages, one page per series. (If you use thousands of rings of one type, you can split the data into several pages if you like). You can choose a separate page for recaptures, or else record recaptures on the relevant ring-series page.

2. Set up the columns in your spreadsheet, and copy the columns to as many pages as you need for your different ring series. If you're using older versions (without pages), then use separate files per ring series. Name the pages (/files) by the ring prefix.
3. Add in the ring data from your field book after each ringing session.

9.3.4 Adding data

- ❑ When you buy rings, add ring numbers to your sheet.
- ❑ To add consecutive ring numbers in Excel: Type the first ring number (e.g. BC06001). Select the cell and click and hold on the bottom right corner (on the plus symbol) and move down with the mouse. The ring numbers are then automatically incremented as you keep on moving. Let go of the left mouse button where you want to end.
- ❑ Some fields need only be filled in if relevant, i.e. Marking, Condition, Colour rings.
- ❑ Mass, Wing, Moult are not compulsory but you are encouraged to fill these in.
- ❑ All other fields must be filled in for each ring record. You may not use dittos or blanks for repeat data. You can use the copy function to copy dates, localities, etc. that are the same.
- ❑ Beware of errors. With computers it is easy to make mistakes!
- ❑ You may have many additional fields (e.g. other measurements) in additional columns for your own use.
- ❑ Do not use 0 or – for data not obtained; leave the cell blank.

9.3.5 Submission of data

- ❑ Send data to SAFRING regularly, and certainly by the end of every ringing year. A good idea is to send data whenever you've handled 100 to 500 birds (over one or several sessions). Then the file will not be too large to send (by e-mail). Choose a new page (/file) in your spreadsheet; copy the lines of unsent records from the different series to this page, as well as unsent recapture records.
- ❑ Copy the page to a separate single file, using your name or ringer's number as a name (e.g. george.xls or 15.xls), and mark the records as having been sent.
- ❑ If you have access to e-mail, mail the data as an attachment to dieter@maths.uct.ac.za.
- ❑ If you don't have e-mail, copy the data to a stiffy disc, put your name on the disc, and post it.
- ❑ When you receive confirmation from SAFRING, check the SAFRING report against your computer records.

9.4 SAFRING SCHEDULE 1 AND 2 FORMS

Ringers without access to computers must submit their ringing returns on SAFRING Schedule 1 forms.

9.4.1 Completing a SAFRING Schedule 1

Schedules must be completed in pen. The Schedule 1 form has three sections. The first is for general data, the second is the schedule summary and the third is the individual ring account.

9.4.1.1 Section 1: general section

- ❑ **First ring number**
- ❑ **Prefix:** (Blocks 1 to 3) – the prefix can either be alpha or numeric and can be one or two characters. (Blocks 4 to 8) – the number of the first ring used during the specific ringing year, e.g. if the first bird ringed after the 1st July got ring AC70011, then this is entered.
- ❑ **Ringer:** Ringer's full initials and surname. (Blocks 9 to 11) – SAFRING ringer's number.
- ❑ **Total used:** (Blocks 12 and 13) – the total number of rings used in the specific series during the ringing year. Do not include rings lost or damaged. If the first ring was 10006 and the last 10040, then the total will be 35.
- ❑ **Date first ring used:** (Blocks 14 to 17) – the month and year of the first ring used after 1 July.
- ❑ **Date last ring used:** (Blocks 18 to 21) – the month and year of the last ring used before or on 30 June.

9.4.1.2 Section 2: schedule summary

- ❑ **Species:** (Blocks 22 to 24) – the three-digit code number of the bird as given in the SAFRING Guide to ring sizes. Do not use the numbers given in any other bird book as this is a different numbering system.
- ❑ **Pulli:** (Blocks 25 and 26) – number of chicks ringed still in the nest.
- ❑ **Full grown: (**Blocks 27 and 28) – the number of free-flying birds ringed.

Note: new forms do not have a Schedule Summary Box; total the species ringed and write it on the schedule.

9.4.1.3 Section 3: individual ring account

There is a maximum of 50 rings per schedule, running either from 01 to 50 or 51 to the next hundred. Schedule 1 forms make provision for both types of series on a single form and the one not applicable must be deleted.

Ring series must always be used in sequence.

Go to the number on the schedule which corresponds with the ring number of the series with which the first bird was ringed during the year and start completing the form from there.

- ❑ **Species:** The three-digit code number as used in Appendix 9.
- ❑ **Age:** Fill in the age code as on the schedule form (or see Electronic data).
- ❑ **Sex:** Fill in the sex code as on the schedule form (or see Electronic data).
- ❑ **Marking:** Fill in the marking code as on the schedule form (or see Electronic data).
- ❑ **Condition:** Fill in the condition code as on the schedule form (or see Electronic data).
- ❑ **Mass:** The weight of the bird is filled in here, a decimal can be used, e.g. a warbler that weighs 10.5 g, and a dove that weighs 105 g. A bird weighing 1.050 kg will be written as 1050.

- **Date:** Written as DDMMYY for day, month, year; 2 February 2000 is 020200.
- **Coordinates:** Filled in, in degrees and minutes.
  - Degrees south read on map from top to bottom.
  - Degrees east read on map from left to right.
- **Locality:** Give town or suburb or feature. For rural sites give approximate distance and direction from nearest mapped place name, e.g. 17 km NW Tuinplaas.
- **Province:** Fill in the abbreviation (two letters per province or country; see Electronic schedules).

9.4.2 SAFRING Schedule 2

This form is completed for recaptures of birds that have been ringed more than 12 months previously or that have completed a full migration cycle, i.e. a bird that migrated north and has returned once more.

9.4.2.1 How to fill in a SAFRING Schedule 2 form

- **Ringer:** Initials, surname and SAFRING ringer's number.
- **Locality:** See detail for SAFRING Schedule 1.
- **Ring number, species, age, sex, ringing date, marking, condition and ringing coordinates:** as for SAFRING Schedule 1.
- **Ringing date (blocks 14 to 19) and ringing coordinates (blocks 22 to 29):** must be the original date and coordinates of the bird's first ringing.
- **Ringer:** (Blocks 30 to 32) SAFRING ringer's number. Blocks 41 to 48 are for official use only.
- **Retrap date:** (Blocks 49 to 54) – date of recapture in day/month/year.
- **Retrap coordinates:** (Blocks 55 to 64) – coordinates of place where bird was recaptured in degrees and minutes.
- **State of bird:** Note down the condition of the bird, e.g. good, poor, in heavy moult, etc.

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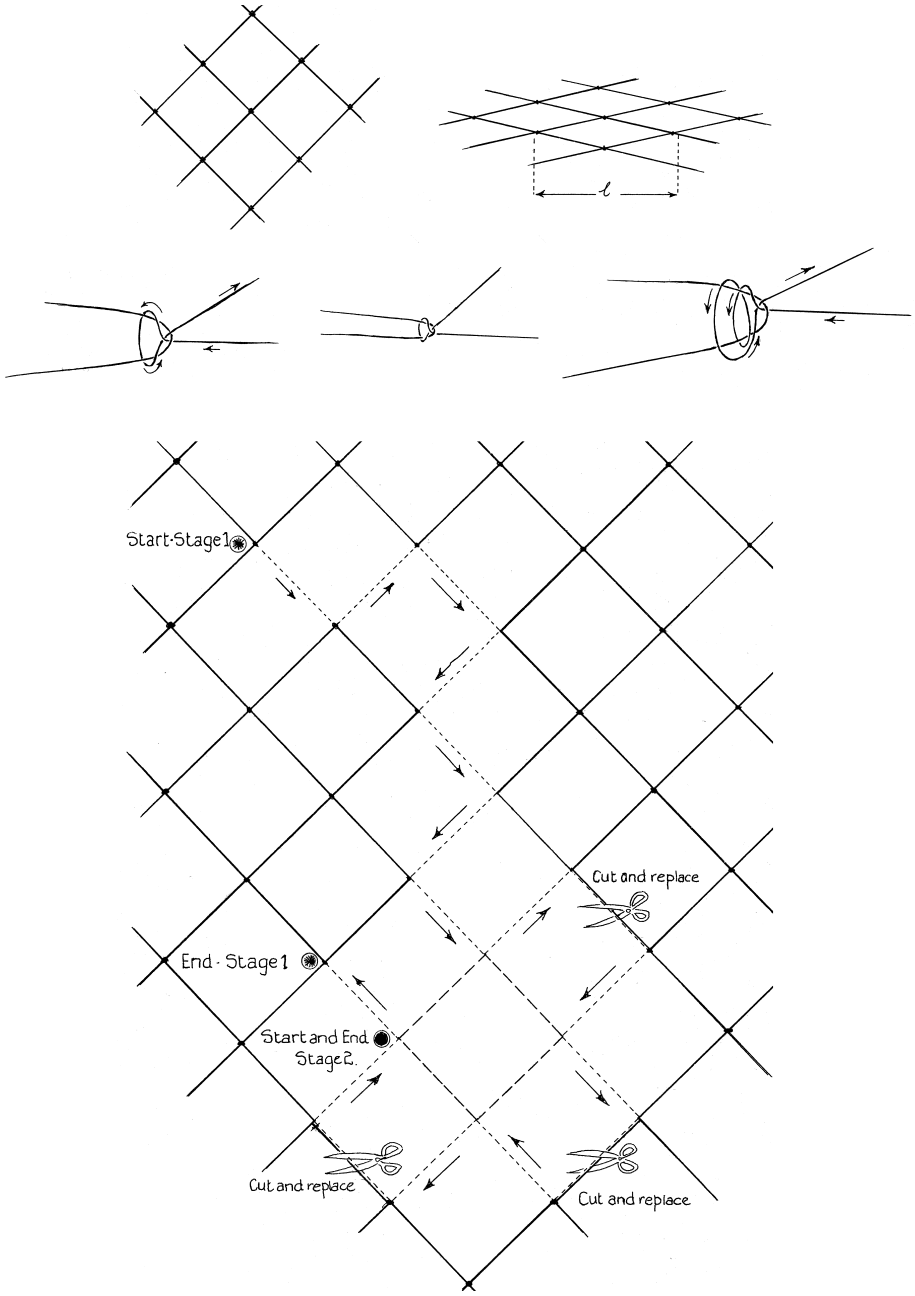
Appendices

APPENDIX 1: MISTNETS

Length	Height	Shelves	Mesh Size	Habitat	Species
12 m RETE	2.4 m	4	16 mm	General	All small/Medium
9 m RETE	2.4 m	4	16 mm	Confined/Open	All small/Medium
6 m RETE	2.4 m	4	16 mm	Confined	All small/Medium
10 m	2.5 m	5	16 mm	Confined	All small/Medium
12 m NR*	2.4 m	4	16 mm	General/Water	All small/Medium
9 m SPYD*	2.1 m	3	16 mm	Confined/Open	All small/Medium
9 m YAM*	1.0 m	1	19 mm	Confined	Wader/Normal
9 m YAM*	2.1 m	4	19 mm	General/Water	Wader/Normal
3 m YAM*	3.0 m	3	16 mm	Confined	All small/Medium
12 m YAM*	2.1 m	2	75 mm	Water	Ducks/Geese

Those marked with an asterisk (*) are no longer readily available, but some can be obtained at an increased cost.

APPENDIX 2: NET REPAIR METHOD



APPENDIX 3: SAFRING SCHEDULE 1 FORM

SAFRING SCHEDULE 1

FIRST RING NUMBER: PREFIX AD | 5671 01 | RINGER: JMH Raijmakers | RINGER'S NUMBER 162 | TOTAL USED 18 | DATE FIRST RING USED: MONTH 01 YEAR 97 | DATE LAST RING USED: MONTH 03 YEAR 97

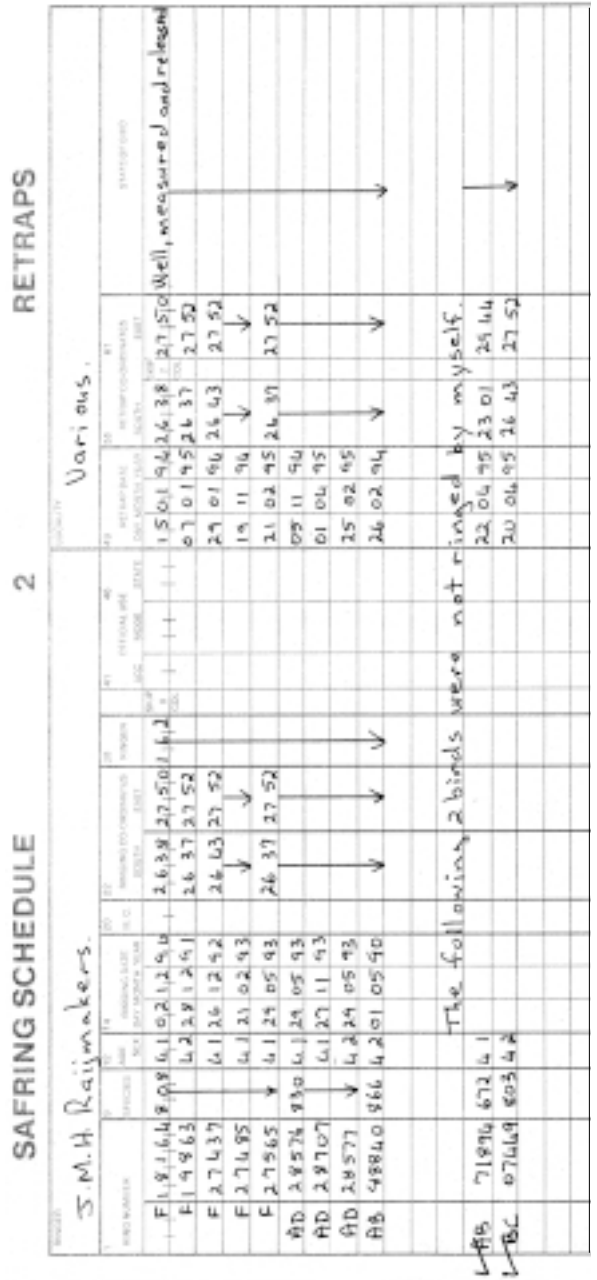
SCHEDULE SUMMARY

SPECIES	PULLI	FULL GROWN
606	3	
775		3
650		1
839		1
621		1
627		1
607		1
622		1
805		4
658		1
502		1

RING	SPECIES	AGE	SEX	MASS	DATE DAY	DATE MONTH	DATE YEAR	MARKING	CONDITION	CO-ORDINATES SOUTH	CO-ORDINATES EAST	43	LOCALITY	PROV
01													Iscor Bird Sanctuary	
~~00~~	606	1	0		11	01	97			26 38	27 50		Vanderbijlpark.	G
2		1	0		15	01	97							
3	↓	1	0		↓	↓	↓			↓	↓		↓	
4	775	4	0	93	19	01	97			26 43	27 52		A. Potgieter Vanderbijlpark	
5	↓	4	0	11	↓	↓	↓			↓	↓		↓	
6	650	4	0	98	16	02	97			26 47	27 45		Boschenvaal Sasolburg	O
7	775	4	0	93										
8	839	4	2	11										
9	621	4	0	116	↓	↓	↓			↓	↓		↓	
10													Buccaneers Retreat	
~~00~~	627	4	0	128	05	03	97			32 50	28 07		Cintsa East	K
1	607	4	0	131	06	03	97							
2	622	4	0	10	07	03	97							
3	—			Ring Lost										
4	805	4	2	195	11	03	97			32 17	24 18		Honingkrantz Graaff Reinet	
5	↓	5	0	182	↓	↓	↓			↓	↓		↓	
6		5	3	168										
7	↓	5	3	182										
8	658	4	0	125										
9	502	4	0	25	↓	↓	↓			↓	↓		↓	
20														
~~21~~														
1														
2														
3														
4														
5														

Please complete **SCHEDULE SUMMARY,** this is needed for compilation of annual totals.
Enter totals for Pulli and Full-grown birds seperately
SEE OVERLEAF FOR CODES

APPENDIX 4: SAFRING SCHEDULE 2 FORM



RING SERIES X42501 – X42550 RING SIZE 1.8 mm H1.

RING NO	ROBERTS NO	SPECIES	AGE	SEX	WING	TAIL	TARSUS	CULMEN	LENGTH	MASS	DATE	TIME	MOULT	LOCALITY AND NOTES
X42526	646	Levaillant's Cisticola	4	3	54	60	21,1	12,0	–	11,3	21/9/85	09h20	✓	Delta (Florence Bloom)
27	673	Chinspot Batis	4	1	62	49	16,0	14,4	–	11,2	7/12/85	09h20		Vaalkopdam (Hoskins)
28	835	Jameson's Firefinch	4	1	46	43	12,5	11,3	–	9,1	8/12/85	10h01		
29	755	Marico Sunbird	4	2	49	31	15,5	20,5	–	6,9		12h37		
X42530	495	Whitethroated Swallow	4	0	130	75/60	10,1	11,5	–	19,8	25/1/86	11h30		Delta (Florence Bloom)
31	775	Cape White Eye	4	0	64	50	18,3	11,4	–	11,5	30/3/86	10h57		
32			4	0	64	45	18,3	11,8	–	11,0		11h33		
33			4	0	62	42	17,8	11,7	–	11,0		11h45		
34			4	0	61	47	18,4	12,2	–	12,2		12h00		
X42535	673	Chinspot Batis	4	2	63	51	18,8	13,3	–	10,5	5/4/86	08h17		Vaalkopdam (Hoskins).
36	839	Blue Waxbill	4	1	53	54	14,0	10,4	–	9,0	4/10/86	15h04	✓	Vaalkopdam (New camp site)
37	599	Willow Warbler	4	0	62	48	18,7	9,6	–	7,5	9/11/87	19h37	✓	Vaalkopdam (Hoskins)
38	601	Burntnecked Eremomela	4	0	–	–	–	–	–	–	10/1/87	10h28		
39	601		4	0	57	44	19,6	12,4	–	8,6		10h30		
X42540	763	Whitebellied Sunbird	4	2	55	36	15,3	22,3	–	7,3		13h50		
41	839	Blue Waxbill	4	0	52	53	14,3	10,0	–	11,5		16h39		
42	599	Willow Warbler	4	0	61	51	16,3	9,2	–	8,8	11/2/87	11h16	✓	Delta (Florence Bloom).
43												h		
44												h		
X42545												h		
46												h		
47												h		
48												h		
49												h		
X42550												h		

APPENDIX 6 : EXAMPLE OF ELECTRONIC DATA TABLE

Ring	Code	Date	Species	Ringer	Age	Sex	Mark	Cond.	Coordinates	Locality	Prov.	Yr	Mass	Wing	Moult
486185	1	21/01/1997	715	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	58.8	89	
486186	1	21/01/1997	390	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	54		
486187	1	14/03/1997	390	32	3	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	31	86	
486188	1	14/03/1997	737	32	3	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	88.5	131	
486189	1	14/03/1997	737	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	85.5	129	
486190	1	01/04/1997	390	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	96	52	92	
CC07729	1	02/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97	40	99.5	000000000
CC07730	1	05/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97		101	000000000
CC07731	1	05/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97		92.5	000000000
CC07732	1	05/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97		103	000000000
CC07733	1	05/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97	38	102	000000000
CC07734	1	09/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97	42.5	101	000000000
CC07735	1	09/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97	39.5	102	000000000
CC07736	1	16/07/1997	545	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97		103	000000000
CC07737	L			32											
482043	2	15/04/1998	390	32	4	0	0	0	3416S 1823E	COGH, Cape Town	WC	97			
486186	2	05/07/1997	390	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97			
486187	2	05/07/1997	390	32	4	0	0	0	2545S 2816E	CSIR, Pretoria	GP	97			

APPENDIX 7: SAFRING POLICY ON DATA EXTRACTIONS

1. **Summaries of total birds ringed:** free (eventually to be put on the Internet).
2. **Biometric data:** not available – contact ringers via Ringers-l listserver.
3. **Moult cards data:** not computerised.
4. **Recoveries:** if already cleaned and published, will eventually be available on the Internet, probably as PDF (Portable Document Format) files on the Biomap site. If cleaned and not published, available if no moratorium exists (>20% of one ringer or specific request) at the Extraction rate. If not cleaned, SAFRING will clean at Extraction plus Clean rate. User may clean at Extraction plus half Clean rate.
   - ❑ Extraction rate: R50 per 200 records.
   - ❑ Clean rate: R3 per record.
5. **Acknowledgements and copies:** Acknowledgements will be made to SAFRING, Avian Demography Unit, University of Cape Town, in all papers and reports where use is made of SAFRING data. At least one copy of all papers and reports shall be sent to SAFRING.

APPENDIX 8: SAFRING POLICY DOCUMENT

Requirements for new ringers: 22 June 2000

To ring birds in southern Africa, three documents are needed.

1. A permit from Nature Conservation, renewed annually, for the province or country in which you wish to ring.
2. A SAFRING authority card, renewed annually, once a ringer is proven to be competent (restrictions on trapping methods and on species ringed apply).
3. Written permission from the landowner to ring on his land.

A new trainee needs to train under supervision of a qualified bird ringer. This will generally take from several months to a year of regular ringing sessions. When the trainee is ready to register at SAFRING as a new ringer, a letter of recommendation by the trainer is required, plus one from at least one independent ringer. The trainer and independent ringer need to satisfy themselves that the new applicant is competent in the following areas applicable to general mistnetting.

1. **Ethics** – be familiar with and understand the ethical codes for bird ringers.
2. **Identification** – be able to identify the birds in the area in which ringing is conducted.
3. **Trapping** – be able to set up and take down mistnets correctly.
4. **Handling birds** – be able to take birds out of nets and other traps, without injuring, killing or exposing them to unnecessary stress; be able to keep them safely prior to ringing and releasing.
5. **Ringing** – be able to put rings on birds properly and use the correct ring size for a specific species by use of the SAFRING ring guide and measuring the tarsus diameter of the bird. Be able to remove badly fitted rings.
6. **Measurements** – be able to record basic measurements accurately, specifically mass, wing length and primary moult.
7. **Record keeping** – understand the administrative procedures and requirements of SAFRING. Be able to complete the ringing data in the correct formats and understand when to submit the data to SAFRING (at least once a year; this may be done on the recognised SAFRING forms or electronically according to the guidelines that may be requested).

If there is doubt about the competence of the person, SAFRING is not obliged to register the person as a ringer.

Where Working Groups exist (e.g. cranes, raptors) ringers are encouraged to become involved in these groups.

Specialised categories that are recognised by SAFRING are detailed below. The above requirements 1 to 7 apply, except where modified below. For these categories an applicant may be requested to submit a proposal to SAFRING indicating the species to be ringed, the area in which ringing will take place, and the time period of the project.

a) **General mistnetting.** Requirements as above.
b) **General mistnetting of limited species.** As above, but for items 5 and 6 experience may be restricted to the species of interest.
c) **Bal-chatri trapping.** Training under a qualified ringer must be obtained to trap raptors. It is the trainee's responsibility to go to the closest ringer who is willing to train him/her. The following points are relevant. The ethics of raptor ringing are stringent. The ethics of raptor ringing are regulated by SAFRING and the Raptor Conservation Group. Instead of mistnets in Item 3, a bal-chatri ringer needs to be able to construct acceptable traps, know how to use them correctly, and take good care of the live prey used as bait. Where a specific project is already being undertaken in a specific area by another ringer, permission should be obtained from the researcher to ring in that area. Becoming a member of the Raptor Conservation Group is encouraged.
d) **Nestlings.** Nestlings of any species, except raptors and seabirds, may be ringed by persons qualified to use mistnets. Raptor nestlings may be ringed by persons qualified to use bal-chatri traps, but coordination with the Raptor Conservation Group is required. In the case of vulture nestlings the Vulture Study Group provides coordination. Additional ethics apply to the ringing of raptor nestlings. Seabird nestlings are dealt with below. In all cases persons need to have experience with ringing as defined above.
e) **Special trapping methods.** These include walk-in traps and cannon nets. The above requirements apply, with the exception of item 3. A proposal is required detailing the project (trap design, previous experience, purpose, length in time of project).
f) **Rehabilitation centres.** Centres that rehabilitate birds, and would like to ring birds prior to release, need to motivate why they wish to ring the birds. The correct ringing process and record keeping are essential (see items 5 and 7 above).
g) **Seabirds.** Seabird colonies are sensitive to disturbance and thus ringers will only be permitted to ring seabird adults or chicks if they work in conjunction with Marine and Coastal Management.
h) **Penguins.** Penguins are threatened birds and putting on flipper bands needs special training.
i) **Special markings.** To use colour rings, dyes, transponders, etc., you need to submit a proposal to SAFRING.
j) **University students.** Students who are not independent qualified ringers need to ring with a qualified ringer who is prepared to help. Students whose studies deal with a particular species are encouraged to qualify as Category 2 ringers. Either the rings of a qualified ringer may be used (then the latter is responsible for schedules) or else the student/university is responsible for the rings and schedules.
k) **Zoos.** To ring captive birds with SAFRING rings, special permission is needed. Record keeping is essential.

Once your application has been successful, you will obtain a ringer's number and kit.

APPENDIX 9: GUIDE TO RING SIZES

m = male
f = female

SS = stainless steel
Inc = incoloy
AA = aluminium alloy
Al = aluminium

- ❑ The **sequence** is taxonomic, which is different to previous editions.
- ❑ The **ring sizes** refer to the internal diameter of the ring. There can be variation in bird size by area and by sex. Before ringing a new species, check the tarsus diameter with a vernier calliper.
- ❑ If a recommended size looks too small, rather use the next largest size. It is easier to overlap a ring that is too large than to remove a ring that is too small.
- ❑ The **prefixes** for different ring sizes are shown in Table 4.2.1.
- ❑ **Primary moult:** the last column indicates the number of primaries a bird has.
  - ✧ 9, 10, 11 = nine, ten or eleven primaries.
  - ✧ 9 + v = nine primaries, plus a vestigial or reduced primary.

No.	English	Ring size	Material	Primaries
2	African Penguin	34	SS	
4	Great Crested Grebe	11	SS	11
5	Blacknecked Grebe	6	SS	11
6	Dabchick	8	SS	11
7	Wandering Albatross	19	SS	10
9	Greyheaded Albatross	12.5	Inc	10
10	Yellownosed Albatross	12.5	Inc	10
12	Darkmantled Sooty Albatross	12.5	Inc	10
13	Southern Giant Petrel (m)	19	SS	10
13	Southern Giant Petrel (f)	16	SS	10
16	Greatwinged Petrel	8	SS	10
19	Softplumaged Petrel	6	SS	10
20	Blue Petrel	4.3	SS	10
21	Broadbilled Prion	4.3	Inc	10
23	Whitechinned Petrel	11	SS	10
24	Grey Petrel	11	SS	10
29	Sooty Shearwater	11	SS	10
30	European Storm Petrel	3	SS	10
31	Leach's Storm Petrel	3	SS	10
39	Redtailed Tropicbird	8	SS	
40	Whitetailed Tropicbird	6	SS	
42	White Pelican	34	SS	
44	Cape Gannet	16	SS	10
47	Whitebreasted Cormorant	16	SS	10

No.	English	Ring	Material	Primaries
48	Cape Cormorant	12.5	Inc	10
49	Bank Cormorant	16	SS	10
50	Reed Cormorant	12.5	Inc	10
51	Crowned Cormorant	12.5	Inc	10
52	Darter	12.5	Inc	
54	Grey Heron	12.5	Inc	10
55	Blackheaded Heron	12.5	Inc	10
56	Goliath Heron	26	Inc	10
57	Purple Heron	11	SS	10
58	Great White Heron	11	SS	10
59	Little Egret	8	SS	10
60	Yellowbilled Egret	8	SS	10
61	Cattle Egret	8	SS	10
62	Squacco Heron	8	SS	10
63	Greenbacked Heron	8	SS	10
64	Black Egret	8	SS	10
65	Rufousbellied Heron	8	SS	10
66	Dwarf Bittern	8	SS	10
67	Little Bittern	8	SS	10
69	Blackcrowned Night Heron	8	SS	10
70	Whitebacked Night Heron	8	SS	10
71	Bittern	8	SS	10
72	Hamerkop	8	SS	10
73	Marabou Stork	26	Inc	
75	Saddlebilled Stork	26	Inc	
76	Yellowbilled Stork	12.5	Inc	
77	Woollynecked Stork	11	SS	
78	Abdim’s Stork	12.5	Inc	
79	Black Stork	16	SS	
80	White Stork	16	SS	
81	Sacred Ibis	11/12.5	SS/Inc	10
82	Bald Ibis	12.5	Inc	10
83	Glossy Ibis	8	SS	10
84	Hadeda Ibis	12.5	Inc	10
85	African Spoonbill	12.5	Inc	10
86	Greater Flamingo	16	SS	
87	Lesser Flamingo	12.5	Inc	
88	Spurwinged Goose	26	Inc	10
89	Egyptian Goose	12.5/16	Inc/SS	10
90	South African Shelduck	11	SS	10
91	Knobbilled Duck	11/12.5	SS/Inc	10
92	Pygmy Goose	8	SS	10
94	Cape Shoveller	11	SS	10
95	African Black Duck	11	SS	10
96	Yellowbilled Duck	11	SS	10

No.	English	Ring	Material	Primaries
97	Redbilled Teal	8	SS	10
98	Cape Teal	8	SS	10
99	Hottentot Teal	6	SS	10
100	Whitefaced Duck	11	SS	10
101	Fulvous Duck	11	SS	10
102	Southern Pochard	11	SS	10
103	Maccoa Duck	11	SS	10
104	Whitebacked Duck	11	SS	10
105	Secretarybird	16	SS	
106	Cape Vulture	26	Inc	10
107	Whitebacked Vulture	26	Inc	10
108	Lappetfaced Vulture	26	Inc	10
109	Whiteheaded Vulture	26	Inc	10
110	Hooded Vulture	19	SS	10
111	Egyptian Vulture			10
112	Palmnut Vulture			10
113	Peregrine Falcon	11	SS	10
114	Lanner Falcon	10	SS	10
115	Hobby Falcon	6/7	SS	10
117	Rednecked Falcon	8	SS	10
119	Eastern Redfooted Kestrel	6	SS	10
121	Dickinson’s Kestrel	6	SS	10
122	Greater Kestrel	6/8	SS	10
123	Rock Kestrel	6	SS	10
125	Lesser Kestrel	6	SS	10
126	Pygmy Falcon	5.25/6	Inc/SS	10
128	Black Kite	12.5	Inc	10
129	Yellowbilled Kite	12.5	Inc	10
130	Blackshouldered Kite	10/11	Inc/SS	10
131	Bat Hawk	8/11	SS	10
133	Black Eagle	26	Inc	10
134	Tawny Eagle	19	SS	10
135	Steppe Eagle	19	SS	10
137	Wahlberg’s Eagle	12.5/16	Inc/SS	10
138	Longcrested Eagle	12.5/16	Inc/SS	10
140	Ayres’ Eagle	12.5/16	Inc/SS	10
141	African Hawk Eagle	16	SS	10
142	Martial Eagle	26	Inc	10
143	Crowned Eagle	26	Inc	10
144	Lizard Buzzard	8	SS	10
145	Brown Snake Eagle	16	SS	10
146	Blackbreasted Snake Eagle	16	SS	10
147	Southern Banded Snake Eagle	12.5	Inc	10
148	Western Banded Snake Eagle	12.5	Inc	10
149	African Fish Eagle	26	Inc	10

No.	English	Ring	Material	Primaries
151	Bateleur	16	SS	10
152	Jackal Buzzard	12.5	Inc	10
153	Augur Buzzard	12.5	Inc	10
154	Steppe Buzzard	11	SS	10
155	Forest Buzzard	11	SS	10
156	Redbreasted Sparrowhawk	8	SS	10
157	Ovambo Sparrowhawk	6	SS	10
158	Little Sparrowhawk	4.3/6	Inc/SS	10
159	Black Sparrowhawk	11	SS	10
160	African Goshawk	8/11	SS	10
161	Little Banded Goshawk	6	SS	10
162	Gabar Goshawk	6/8	SS	10
163	Dark Chanting Goshawk	8/11	SS	10
165	Pale Chanting Goshawk	8/11	SS	10
167	African Marsh Harrier	8	SS	10
169	Black Harrier	8/11	SS	10
171	Gymnogene	11/12.5	SS/Inc	10
173	Coqui Francolin	6	SS	
174	Crested Francolin	8	SS	
176	Greywing Francolin	8	SS	
179	Orange River Francolin	8	SS	
181	Cape Francolin	11	SS	
182	Redbilled Francolin	11	SS	
183	Natal Francolin	11	SS	
185	Swainson’s Francolin	11	SS	
189	Common Quail	4.3	AA	
190	Harlequin Quail	4.3	AA	
191	Blue Quail	3.5	AA	
192	Helmeted Guineafowl	11/12.5	SS/Inc	
196	Kurrichane Buttonquail	3	SS	10
197	African Rail	6	SS	10
198	Corncrake	6	SS	10
199	African Crake	4.3/6	SS/Inc	10
201	Spotted Crake	4.3/5.25	Inc	10
202	Baillon’s Crake	3.3/4.3	Inc	10
203	Black Crake	6	SS	10
205	Redchested Flufftail	3.5	AA	10
206	Buffspotted Flufftail	3.5	AA	10
208	Purple Gallinule	11	SS	10
209	Lesser Gallinule	6	SS	10
210	Moorhen	8	SS	10
211	Lesser Moorhen	6	SS	10
212	Redknobbed Coot	11	SS	10
214	Crowned Crane	16	SS	10
215	Wattled Crane	19	SS	

No.	English	Ring	Material	Primaries
216	Blue Crane	16	Inc/SS	
220	Karoo Korhaan	11	SS	
221	Rüppell’s Korhaan	10	Inc	
224	Redcrested Korhaan	11	SS	
225	Black Korhaan	8	SS	
228	African Jacana	6/8	SS	10
229	Lesser Jacana	4.3	Inc	10
230	Painted Snipe	5.3	Inc	10
231	African Black Oystercatcher	8	SS	10
232	Turnstone	4.3	Inc	10
233	Ringed Plover	3	SS	10
235	Whitefronted Plover	2.8	SS	10
236	Chestnutbanded Plover	2.8	SS	10
237	Kittlitz’s Plover	2.8	SS	10
238	Threebanded Plover	2.8	SS	10
239	Sand Plover	4.3	Inc	10
240	Caspian Plover	4.3	Inc	10
241	Grey Plover	5.3	Inc	10
242	Crowned Plover	5.3	Inc	10
243	Blackwinged Plover	5.3	Inc	10
245	Blacksmith Plover	5.3	Inc	10
247	Wattled Plover	6	SS	10
249	Great Snipe	5.3	Inc	10
250	Ethiopian Snipe	5.3	Inc	10
251	Curlew Sandpiper	3	SS	10
253	Little Stint	2.3	SS	10
254	Knot	4.3	Inc	10
255	Sanderling	3	SS	10
256	Ruff	4.3/5.25	Inc	10
257	Terek Sandpiper	3	SS	10
258	Common Sandpiper	3	SS	10
259	Green Sandpiper	4.3	Inc	10
261	Redshank	3.3/4.3	Inc	10
262	Marsh Sandpiper	3/3.3	SS/Inc	10
263	Greenshank	5.25	Inc	10
264	Wood Sandpiper	3/3.3	SS/Inc	10
265	Blacktailed Godwit	5.25	Inc	10
266	Bartailed Godwit	5.25	Inc	10
268	Whimbrel	8	SS	10
269	Avocet	5.25/6	Inc/SS	10
270	Blackwinged Stilt	5.3	Inc	10
274	Water Dikkop	6	SS	10
275	Spotted Dikkop	7/8	SS	10
276	Burchell’s Courser	4.3	AA	10
277	Temminck’s Courser	4.3	AA	10

No.	English	Ring	Material	Primaries
278	Doublebanded Courser	4.3	AA	10
279	Threebanded Courser	4.3	AA	10
280	Bronzewinged Courser	5.25	AA	10
281	Redwinged Pratincole	4.3	AA	10
282	Blackwinged Pratincole	4.3	AA	10
283	Rock Pratincole	3	SS	10
286	Subantarctic Skua	12.5	Inc	10
287	Kelp Gull	10/11	Inc/SS	10
288	Greyheaded Gull	6	SS	10
289	Hartlaub's Gull	6	SS	10
290	Caspian Tern	8	SS	10
291	Common Tern	3	SS	10
292	Antarctic Tern	4.3	Inc	10
293	Roseate Tern	3	SS	10
294	Arctic Tern	3	SS	10
295	Sooty Tern	3	SS	10
296	Sandwich Tern	4.3	Inc	10
298	Swift Tern	6	SS	10
299	Little Tern	2.8	SS	10
300	Damara Tern	2.8	SS	10
304	Whitewinged Tern	3	SS	10
305	Whiskered Tern	4.3	Inc	10
903	Black Tern	3	SS	10
306	African Skimmer	4.3	Inc	
307	Namaqua Sandgrouse	6	AA	11
308	Burchell's Sandgrouse	6	AA	11
309	Yellowthroated Sandgrouse	6	AA	11
310	Doublebanded Sandgrouse	6	AA	11
311	Rock Pigeon	7/8	Al	10
312	Rameron Pigeon	8	Al	10
314	Redeyed Dove	6	SS/Al	10
315	African Mourning Dove	6	Al	10
316	Cape Turtle Dove	5.25/6	AA/Al	10
317	Laughing Dove	5.3	AA	10
318	Namaqua Dove	3.5	AA	10
319	Tambourine Dove	5.25	AA	10
320	Bluespotted Dove	4.5	Al	10
321	Greenspotted Dove	4.5	Al	10
322	Cinnamon Dove	5.3	AA	10
323	Green Pigeon	8	Al	10
327	Meyer's Parrot	6	SS	10
330	Rosyfaced Lovebird	4.2	SS	10
336	Knysna Lourie	6	Al	10
337	Purplecrested Lourie	6	Al	10
339	Grey Lourie	6	Al	10

No.	English	Ring	Material	Primaries
340	European Cuckoo	5.3	AA	10
342	Lesser Cuckoo	3.5/4.5	AA/Al	10
343	Redchested Cuckoo	4.3	AA	10
344	Black Cuckoo	4.3	AA	10
346	Great Spotted Cuckoo	6	Al	10
347	Striped Cuckoo	6	Al	10
348	Jacobin Cuckoo	6	Al	10
350	Emerald Cuckoo	3	Al	10
351	Klaas's Cuckoo	3/3.5	Al/AA	10
352	Diederik Cuckoo	3.5	AA	10
356	Burchell's Coucal	8	SS	10
358	Green Coucal	4.3/5.25	AA	10
359	Barn Owl	8/11	SS	10
360	Grass Owl	10/11	Inc/SS	10
361	Marsh Owl	8/11	SS	10
362	Wood Owl	12.5	Inc	10
363	African Scops Owl	4.3	Inc	10
364	Whitefaced Owl	6/8	SS	10
365	Pearlspotted Owl	6/8	SS	10
366	Barred Owl	6/8	SS	10
367	Cape Eagle Owl	16	SS	10
368	Spotted Eagle Owl	12.5	Inc	10
369	Giant Eagle Owl	16	SS	10
371	European Nightjar	4.5	Al	10
372	Rufouscheeked Nightjar	3	Al	10
373	Fierynecked Nightjar	3	Al	10
374	Freckled Nightjar	4.5	Al	10
376	Mozambique Nightjar	3/3.5	Al/AA	10
377	Pennantwinged Nightjar	4.3	AA	10
378	European Swift	2.5 E	Al	10
380	Black Swift	2.5 E	Al	10
382	Mottled Swift	2.5 E	Al	10
383	Whiterumped Swift	2.5 E	Al	10
384	Horus Swift	2.5 E	Al	10
385	Little Swift	2.5 E	Al	10
386	Alpine Swift	D	Al	10
387	Palm Swift	2.5 E	Al	10
388	Mottled Spinetail	2.5 E	Al	10
389	Böhm's Spinetail	2.5 E	Al	10
390	Speckled Mousebird	3.5/4.3	AA	
391	Whitebacked Mousebird	3.5	AA	
391	Whitebacked Mousebird	4.3	AA	
392	Redfaced Mousebird	3.5/4.3	AA	
393	Narina Trogon	3/3.5	Al/AA	9
394	Pied Kingfisher	4.3/4.5	AA/Al	10

No.	English	Ring	Material	Primaries
395	Giant Kingfisher	8/10	SS/Inc	10
396	Halfcollared Kingfisher	2.5	Al	10
397	Malachite Kingfisher	2.5E/Y	Al	10
398	Pygmy Kingfisher	2.5	Al	10
399	Woodland Kingfisher	2.5E/4.3	Al/AA	10
400	Mangrove Kingfisher	4.3	AA	10
401	Greyhooded Kingfisher	4.5	Al	10
402	Brownhooded Kingfisher	2.5E/4.3	Al/AA	10
403	Striped Kingfisher	3.5	Al	10
404	European Bee-eater	3.5	AA	9+v
405	Bluecheeked Bee-eater	3.5	AA	9+v
406	Olive Bee-eater	3.5	AA	9+v
407	Carmine Bee-eater	4.3	AA	9+v
408	Böhm's Bee-eater	3.5	AA	9+v
409	Whitefronted Bee-eater	3	Al	9+v
410	Little Bee-eater	2.8	AA	9+v
411	Swallowtailed Bee-eater	2.5 E	Al	9+v
412	European Roller	6	Al	
413	Lilacbreasted Roller	6	Al	
416	Broadbilled Roller	6	Al	
418	Hoopoe	3.5/4.3	AA	10
419	Redbilled Woodhoopoe	6	Al	10
420	Violet Woodhoopoe	6	Al	10
421	Scimitarbilled Woodhoopoe	4.3	AA	10
422	Trumpeter Hornbill	12.5	Inc	10
424	Grey Hornbill	8	Al	10
425	Redbilled Hornbill	6/8	SS	10
426	Southern Yellowbilled Hornbill	6/8	SS	10
427	Crowned Hornbill	6/8	SS	10
431	Blackcollared Barbet	3.3/4.3	AA	
432	Pied Barbet	3.3/4.3	AA	
433	White-eared Barbet	3.3	Inc	
434	Whyte's Barbet	3.3	Inc	
436	Redfronted Tinker Barbet	2.3	AA	
437	Yellowfronted Tinker Barbet	2.3	AA	
438	Goldenrumped Tinker Barbet	2.3	AA	
439	Crested Barbet	4.3	AA	
440	Greater Honeyguide	3.5	AA	9+v
441	Scalythroated Honeyguide	3.5	AA	9+v
441	Scalythroated Honeyguide	3	Al	9+v
442	Lesser Honeyguide	3	Al	9+v
443	Sharpbilled Honeyguide	2.3	AA	9
444	Slenderbilled Honeyguide	2.3	AA	9
445	Ground Woodpecker	4.3	AA	9+v
446	Bennett's Woodpecker	4.3	AA	9+v

No.	English	Ring	Material	Primaries
447	Goldentailed Woodpecker	4.3	AA	9+v
448	Knysna Woodpecker	4.3	AA	9+v
450	Cardinal Woodpecker	3/3.5	Al/AA	9+v
451	Bearded Woodpecker	4.3	AA	9+v
452	Olive Woodpecker	4.3	AA	9+v
453	Redthroated Wryneck	4.3	AA	9+v
454	African Broadbill	2.3/2.8	AA	
456	Melodious Lark	2.3	AA	9+v
457	Monotonous Lark	2.3	AA	9+v
458	Rufousnaped Lark	3	Al	9+v
459	Fawncoloured Lark	2.3	AA	9+v
460	Sabota Lark	3	Al	9+v
463	Thickbilled Lark	3	Al	9+v
466	Clapper Lark			9+v
468	Flappet Lark	2.8	AA	9+v
474	Spikeheeled Lark	2.8	AA	9+v
480	Dune Lark	2.8	AA	9+v
484	Chestnutbacked Finchlark	2.3	AA	9+v
486	Blackeared Finchlark	2.3	AA	9+v
488	Redcapped Lark	2.3	AA	9+v
490	Pinkbilled Lark	2.3	AA	9+v
492	Stark's Lark	2.3	AA	9+v
493	European Swallow	2.3	AA	9
494	Angola Swallow	1.8/2.3	Al/AA	9
495	Whitethroated Swallow	2.3	AA	9
496	Wiretailed Swallow	2.3/2.5Y	AA/Al	9
497	Blue Swallow	1.8	Al	9
498	Pearlbreasted Swallow	1.8/2.3	Al/AA	9
499	Greyrumped Swallow	1.8	Al	9
500	Mosque Swallow	2.8	AA	9
501	Redbreasted Swallow	2.8/3	AA/Al	9
502	Greater Striped Swallow	2.3/2.8	AA	9
503	Lesser Striped Swallow	2.3/2.8	AA	9
504	South African Cliff Swallow	2.3	AA	9
506	Rock Martin	2.3	AA	9
507	House Martin	2.3	AA	9
508	Sand Martin	2.3	AA	9
509	Brownthroated Martin	1.8/2.3	Al/AA	9
510	Banded Martin	2.3	AA	9
511	Black Sawwing Swallow	1.8	Al	9
512	Eastern Sawwing Swallow	1.8	Al	9
513	Black Cuckooshrike	2.8/3	AA/Al	10
514	Ashy Tit	2.8	AA	10
515	Whitebreasted Cuckooshrike	3.5/4.5	AA/Al	10
516	Grey Cuckooshrike	3.5	AA	10

No.	English	Ring	Material	Primaries
517	Forktailed Drongo	3.3/4.3	Inc/AA	10
518	Squaretailed Drongo	2.8/3	AA/Al	10
519	European Golden Oriole	4.3	AA	10
520	African Golden Oriole	4.3	AA	10
521	Blackheaded Oriole	4.3	AA	10
522	Pied Crow	8	SS	10
523	Black Crow	8	SS	10
524	Whitenecked Raven	10/11	Inc/SS	10
525	Southern Grey Tit	2.8	AA	10
526	Northern Grey Tit	2.3	AA	10
527	Southern Black Tit	2.3/2.8	AA	10
529	Rufousbellied Tit	2.3	AA	10
530	Grey Penduline Tit	1.8/2.3	Al/AA	10
531	Cape Penduline Tit	1.8/2.3	Al/AA	10
533	Arrowmarked Babbler	4.3/4.5	AA/Al	10
535	Hartlaub's Babbler	4.3	AA	10
536	Pied Babbler	4.5	Al	10
540	Cape Rockjumper	3.5/4.5	AA	10
542	Bush Blackcap	3	Al	10
543	Cape Bulbul	3	Al	10
544	Redeyed Bulbul	3	Al	10
545	Blackeyed Bulbul	3/3.5	Al/AA	10
546	Terrestrial Bulbul	3/3.5	Al/AA	10
547	Yellowstreaked Bulbul	3/3.5	Al/AA	10
548	Slender Bulbul	3	Al	10
549	Stripecheeked Bulbul	3/3.5	Al/AA	10
550	Yellowbellied Bulbul	3/3.5	Al/AA	10
551	Sombre Bulbul	3	Al	10
552	Kurrichane Thrush	3.5/4.3	AA	10
553	Olive Thrush	3.5/4.3	AA	10
556	Orange Thrush	3.5	AA	10
557	Groundscraper Thrush	3.5/4.3	AA	10
558	Spotted Thrush	3.5	AA	10
559	Cape Rock Thrush	3/3.5	Al/AA	10
561	Shorttoed Rock Thrush	3	Al	10
562	Miombo Rock Thrush	3.5	AA	10
563	European Wheatear	3	Al	10
564	Mountain Chat	3	Al	10
566	Karoo Chat	3	Al	10
568	Capped Wheatear	3	Al	10
569	Buffstreaked Chat	3	Al	10
570	Familiar Chat	2.3	AA	10
573	Mocking Chat	3	Al	10
574	Arnot's Chat	3	Al	10
575	Anteating Chat	3	Al	10

No.	English	Ring	Material	Primaries
576	Stonechat	2.3	AA	10
577	Whinchat	2.3	AA	10
578	Chorister Robin	3	Al	10
579	Natal Robin	3	Al	10
580	Heuglin's Robin	3	Al	10
581	Cape Robin	2.8	AA	10
582	Whitethroated Robin	2.3/2.8	AA	10
583	Karoo Robin	2.3/2.8	AA	10
584	Brown Robin	2.8	AA	10
585	Bearded Robin	2.8	AA	10
586	Kalahari Robin	2.8	AA	10
587	Cholo Alethe	3	Al	10
588	Whitebrowed Robin	2.3/2.8	AA	10
589	Starred Robin	2.3	AA	10
590	Swynnerton's Robin	2.3	AA	10
591	Gunning's Robin	2.3	AA	10
592	Thrush Nightingale	2.3	AA	10
593	Collared Palm Thrush	3	Al	10
594	Whitethroat	2.3	AA	10
595	Garden Warbler	2.3	AA	10
596	Icterine Warbler	2.3	AA	10
597	Olivetree Warbler	2.3	AA	10
598	River Warbler	2.3	AA	10
599	Willow Warbler	1.8	Al	10
600	Yellowbellied Eremomela	1.8	Al	10
601	Burntnecked Eremomela	1.8	Al	10
602	Greencapped Eremomela	1.8	Al	10
603	Great Reed Warbler	3	Al	10
604	Cape Reed Warbler	2.8/3	AA/Al	10
606	African Marsh Warbler	1.8/2.3	Al/AA	10
607	European Marsh Warbler	2.3	AA	10
608	European Sedge Warbler	1.8/2.3	Al/AA	10
609	African Sedge Warbler	2.3	AA	10
911	European Reed Warbler	2.3	AA	10
949	Basra Reed Warbler	2.3/2.8	AA	10
610	Barratt's Warbler	2.3	AA	10
612	Victorin's Warbler	2.3	AA	10
614	Barred Warbler	2.3/2.8	AA	10
615	Stierling's Barred Warbler	2.3	AA	10
617	Moustached Warbler	4.5	AA	10
618	Grassbird	3/3.5	Al/AA	10
619	Rufous-eared Warbler			10
621	Longbilled Crombec	2.3	AA	10
622	Barthroated Apalis	2.3	AA	10
624	Rudd's Apalis	1.8/2.3	Al	10

No.	English	Ring	Material	Primaries
625	Yellowbreasted Apalis	1.8	Al	10
627	Bleating Warbler	2.3	AA	10
628	Greybacked Warbler	1.8/2.3	Al/AA	10
629	Fantailed Cisticola	1.8	Al	10
630	Desert Cisticola	1.8/2.3	Al/AA	10
631	Cloud Cisticola	1.8/2.3	Al/AA	10
634	Ayres' Cisticola	1.8/2.3	Al/AA	10
636	Shortwinged Cisticola	1.8/2.3	Al/AA	10
637	Neddicky	1.8	Al	10
638	Greybacked Cisticola	1.8	Al	10
639	Wailing Cisticola	2.3	AA	10
641	Tinkling Cisticola	1.8/2.3	Al/AA	10
642	Rattling Cisticola	2.8	AA	10
643	Singing Cisticola	1.8	Al	10
644	Redfaced Cisticola	2.3	AA	10
645	Blackbacked Cisticola	2.3/2.8	AA	10
646	Levaillant's Cisticola	2.3	AA	10
647	Croaking Cisticola	2.3	AA	10
648	Lazy Cisticola	2.3	AA	10
649	Tawnyflanked Prinia	1.8/2.3	Al/AA	10
650	Blackchested Prinia	1.8/2.3	Al/AA	10
651	Karoo Prinia	1.8/2.3	Al/AA	10
653	Namaqua Warbler	1.8/2.3	Al/AA	10
654	Spotted Flycatcher	2.3	AA	10
655	Dusky Flycatcher	2.3	AA	10
656	Bluegrey Flycatcher	2.3	AA	10
657	Fantailed Flycatcher	2.3	AA	10
658	Titbabbler	2.3	AA	10
659	Layard's Titbabbler	2.3	AA	10
660	Herero Chat	3	Al	10
661	Marico Flycatcher	2.3	AA	10
662	Pallid Flycatcher	2.3	AA	10
663	Chat Flycatcher	2.3	AA	10
664	Black Flycatcher	2.3/2.8	AA	10
665	Fiscal Flycatcher	2.8	AA	10
666	Yellow Warbler	1.8/2.3	Al/AA	10
671	Yellowthroated Warbler	1.8	Al	10
672	Cape Batis	1.8/2.3	Al/AA	10
673	Chinspot Batis	1.8/2.3	Al/AA	10
674	Pririt Batis	1.8	Al	10
675	Mozambique Batis	1.8/2.3	Al/AA	10
677	Wattle-eyed Flycatcher	2.3	AA	10
678	Fairy Flycatcher	1.8	Al	10
680	Bluemantled Flycatcher	2.3	AA	10
681	Whitetailed Flycatcher	1.8	Al	10

No.	English	Ring	Material	Primaries
682	Paradise Flycatcher	2.3	AA	10
685	African Pied Wagtail	2.8/3	SS	9
686	Cape Wagtail	2.3/2.8	AA	9
688	Longtailed Wagtail	3	SS	9
689	Yellow Wagtail	2.3/2.8	AA	9
692	Grassveld Pipit	2.3/2.8	AA	9
693	Longbilled Pipit	2.3	AA	9
694	Plainbacked Pipit	2.8	AA	9
695	Buffy Pipit	2.3	AA	9
696	Striped Pipit	3	Al	9
698	Tree Pipit	2.3	AA	9
703	Orangethroated Longclaw	3.5/4.5	AA/Al	9
704	Yellowthroated Longclaw	3.5/4.5	AA/Al	9
705	Pinkthroated Longclaw	3	Al	9
706	Lesser Grey Shrike	3.5	AA	10
707	Fiscal Shrike	3/3.3	Al/Inc	10
708	Redbacked Shrike	3	Al	10
709	Southern Boubou	3.3	Inc	10
710	Swamp Boubou			10
711	Crimsonbreasted Shrike	3	Al	10
712	Puffback	3	Al/SS	10
713	Southern Tchagra	3.3	Inc	10
714	Threestreaked Tchagra	3/3.3	Al/Inc	10
715	Blackcrowned Tchagra	3/3.3	SS/Inc	10
717	Olive Bush Shrike	3	Al	10
719	Orangebreasted Bush Shrike	3	Al	10
720	Blackfronted Bush Shrike	3/3.5	Al/AA	10
721	Gorgeous Bush Shrike	3	Al	10
722	Bokmakierie	4.3	AA	10
723	Greyheaded Bush Shrike	4.3	AA	10
724	Longtailed Shrike	5.25	AA	10
725	Yellowspotted Nicator	3.5	Al	10
727	White Helmetshrike	3	Al	10
728	Redbilled Helmetshrike	3/3.3	Al/Inc	10
730	Whitecrowned Shrike	5.25/6	AA/Al	10
731	Brubru	3	SS	10
733	European Starling	4.3	AA	9+v
734	Indian Myna	4.5/5.25	Al/AA	9+v
735	Wattled Starling	4.3	AA	9+v
736	Plumcoloured Starling	3.3/3.5	Inc/AA	9+v
737	Glossy Starling	4.3/5.25	AA	9+v
738	Greater Blue-eared Starling	4.3	AA	9+v
739	Lesser Blue-eared Starling	4.3	AA	9+v
740	Blackbellied Starling	4.3	AA	9+v
741	Sharptailed Starling	4.3	AA	9+v

No.	English	Ring	Material	Primaries
742	Longtailed Starling	4.3/6	AA/Al	9+v
743	Burchell's Starling	6	Al	9+v
744	Palewinged Starling	4.3	AA	9+v
745	Redwinged Starling	4.3/5.25	AA	9+v
746	Pied Starling	4.3	AA	9+v
748	Redbilled Oxpecker	4.5	Al	
749	Cape Sugarbird	4.3	AA	
750	Gurney's Sugarbird	4.3	AA	
751	Malachite Sunbird	2.3	AA	10
752	Bronze Sunbird	2.3	AA	10
753	Orangebreasted Sunbird	1.8/2.3	Al/AA	10
754	Coppery Sunbird	1.8/2.3	Al/AA	10
755	Marico Sunbird	1.8/2.3	Al/AA	10
756	Purplebanded Sunbird	1.8	Al	10
757	Shelley's Sunbird	2.3	AA	10
758	Greater Doublecollared Sunbird	2.3	AA	10
759	Miombo Doublecollared Sunbird	1.8/2.3	Al/AA	10
760	Lesser Doublecollared Sunbird	1.8	Al	10
761	Neergaard's Sunbird	1.8/2.3	Al/AA	10
762	Yellowbellied Sunbird	1.8	Al	10
763	Whitebellied Sunbird	1.8/2.3	Al/AA	10
764	Dusky Sunbird	1.8/2.3	Al/AA	10
765	Grey Sunbird	1.8/2.3	Al/AA	10
766	Olive Sunbird	1.8/2.3	Al/AA	10
770	Violetbacked Sunbird	2.3	AA	10
771	Collared Sunbird	1.8	Al	10
772	Black Sunbird	1.8/2.3	Al/AA	10
774	Scarletchested Sunbird	2.3	AA	10
775	Cape White-eye	2.3	AA	9
777	Yellow White-eye	1.8/2.3	Al/AA	9
779	Redbilled Buffalo Weaver	4.3	AA	9+v
780	Whitebrowed Sparrowweaver	4.3	AA	9+v
783	Sociable Weaver	3/3.3	SS/Inc	9+v
784	House Sparrow	2.8	AA	9+v
785	Great Sparrow	3	Al	9+v
786	Cape Sparrow	2.8	AA	9+v
787	Southern Greyheaded Sparrow	2.8	AA	9+v
788	Yellowthroated Sparrow	2.8/3	AA/Al	9+v
789	Scalyfeathered Finch	2.3	Al Al	9+v
790	Forest Weaver	3	SS	9+v
791	Spectacled Weaver	3	SS	9+v
792	Lesser Masked Weaver	2.3/3	AA/SS	9+v
793	Redheaded Weaver	3	SS	9+v
796	Chestnut Weaver	3	SS	9+v
797	Spottedbacked Weaver	3/3.3	SS/Inc	9+v

No.	English	Ring	Material	Primaries
799	Cape Weaver	3/3.3	SS/Inc	9+v
800	Yellow Weaver	3	SS	9+v
801	Golden Weaver	3	SS	9+v
802	Brownthroated Weaver	2.3/3	SS	9+v
803	Masked Weaver	3	SS	9+v
804	Thickbilled Weaver	4.3	AA	9+v
805	Redbilled Quelea	2.3	AA	9+v
806	Redheaded Quelea	2.3	AA	9+v
808	Red Bishop	2.8	AA	9+v
809	Firecrowned Bishop	2.3/2.8	AA	9+v
810	Yellowrumped Widow	3/3.5	Al/AA	9+v
812	Golden Bishop	2.3	AA	9+v
813	Redcollared Widow	2.3/2.8	AA	9+v
814	Whitewinged Widow	2.3	AA	9+v
815	Yellowbacked Widow	2.3/3	AA/Al	9+v
816	Redshouldered Widow	2.8/3	AA/Al	9+v
818	Longtailed Widow	3	Al	9+v
820	Redheaded Finch	2.3	Al Al	9+v
821	Cutthroat Finch	2.3	Al Al	9+v
822	Pied Mannikin	2.3	AA	9+v
823	Bronze Mannikin	1.8/2.3	Al/AA	9+v
824	Redbacked Mannikin	1.8/2.3	Al/AA	9+v
825	Swee Waxbill	1.8	Al	9+v
826	East African Swee	1.8	Al	9+v
827	Green Twinspot	1.8	Al	9+v
828	Redfaced Crimsonwing	2.3	AA	9+v
829	Goldenbacked Pytilia	2.3	AA	9+v
830	Melba Finch	2.3	AA	9+v
832	Redthroated Twinspot	2.3	AA	9+v
833	Bluebilled Firefinch	1.8/2.3	Al/AA	9+v
835	Jameson's Firefinch	1.8	Al	9+v
836	Brown Firefinch	1.8	Al	9+v
837	Redbilled Firefinch	1.8	Al	9+v
838	Orangebreasted Waxbill	1.8	Al	9+v
839	Blue Waxbill	1.8/2.3	Al/AA	9+v
840	Violeteared Waxbill	2.3	AA	9+v
841	Blackcheeked Waxbill	1.8	Al	9+v
842	Grey Waxbill	1.8	Al	9+v
843	Common Waxbill	1.8	Al	9+v
844	Quail Finch	1.8	Al	9+v
846	Pintailed Whydah	2.3	Al	9+v
847	Shaft-tailed Whydah	2.3	Al	9+v
849	Black Widowfinch	2.3	AA	9+v
850	Purple Widowfinch	2.3	AA	9+v
851	Steelblue Widowfinch	2.3	AA	9+v

No.	English	Ring	Material	Primaries
852	Paradise Whydah	2.3	AA	9+v
853	Broadtailed Paradise Whydah	2.3	AA	9+v
854	Cuckoo Finch	2.3	AA	9+v
855	Cape Siskin	1.8/2.3	Al/AA	9
857	Cape Canary	2.3	AA	9
858	Forest Canary	2.3	AA	9
859	Yelloweyed Canary	2.3	AA	9
860	Blackthroated Canary	1.8/2.3	Al/AA	9
861	Blackheaded Canary	2.3	AA	9
863	Bully Canary	2.3	AA	9
865	Whitethroated Canary	2.3/2.8	AA	9
866	Yellow Canary	2.3	AA	9
867	Streakyheaded Canary	2.3/2.8	AA	9
868	Blackeared Canary	2.3	AA	9
869	Protea Canary	2.8	AA	9
870	Chaffinch	2.3	AA	9
871	Larklike Bunting	2.3	AA	9
872	Rock Bunting	2.3	AA	9
873	Cape Bunting	2.3	AA	9
874	Goldenbreasted Bunting	2.3	AA	9
875	Cabanis's Bunting	2.3	AA	9

The Avian Demography Unit at the University of Cape Town has produced the following books:

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- Oatley, T.B., Oschadleus, H.D., Navarro, R.A. & Underhill, L.G. 1998. **Review of Ring Recoveries of Birds of Prey in Southern Africa: 1948–1998.** Johannesburg: Endangered Wildlife Trust.
- Barnes, K.N. 1998. **The Important Bird Areas of Southern Africa.** Johannesburg: BirdLife South Africa.
- Parker, V. 1999. **The Atlas of the Birds of Sul do Save, Southern Mozambique.** Cape Town & Johannesburg: Avian Demography Unit & Endangered Wildlife Trust.
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- Underhill, L.G., Tree, A.J., Oschadleus, H.D. & Parker, V. 1999. **Review of Ring Recoveries of Waterbirds in Southern Africa.** Cape Town: Avian Demography Unit.
- Barnes, K.N. (ed.) 2000. **The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland.** Johannesburg: BirdLife South Africa.
- Crawford, R.J.M. & Dyer, B.M. 2000. **Wildlife of Robben Island.** Bright Continent Guide 1. Cape Town: Avian Demography Unit.
- Parker, V. & De Boer, F. 2000. **Birds of the Maputo Special Reserve, Mozambique.** Bright Continent Guide 2. Cape Town: Avian Demography Unit.
- Whittington, P. 2001. **The Adventures of Peter the Penguin.** Cape Town: Avian Demography Unit.

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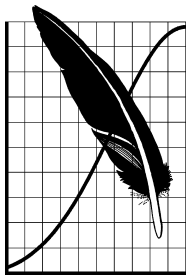


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