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Bird Atlas as an Indispensable Monitoring Tool: How the First One Was Conceived in Finland and Implications for Iran

ELLEN VUOSALO-TAVAKOLI
Shahrak Ferdows, Ruyan, Mazandaran, IRAN (Honorary member of BirdLife Finland).
Email: ellentavakoli@excite.com.

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Abstract: This paper summarizes discussion on the preparation of the first Bird Atlas in Finland (BAF) 30 years ago, along with references to more recent Bird Atlases in other countries. This discourse emphasises that atlasing is an exemplary process for producing an important monitoring tool that for recording environmental changes and threatened habitats in a given country and for monitoring ornithological biodiversity in a region. The essence of a bird atlas lies in what its maps can depict and what can be derived from them. Here, the essential components of the first BAF and subsequent Finnish atlases are described and examples of bird distribution maps from a variety of sources are explained. A concise history of bird atlases can be derived from the cited examples, but the multiple references provide relevant source information for the ongoing process of the first Bird Atlas of Iran.

Keywords: Bird atlas, biodiversity, distribution, Finland, Iran.

INTRODUCTION

Bird Atlases were not realised in Europe until the 1970s, when the work of ornithologists in the British Isles and France resulted in the publication of the first comprehensive atlases of breeding birds 38 years ago (Sharrock 1976, Yeatman 1976). In Britain, the second atlas was Gibbons *et al*. 1993. In France, the first wintering atlas was Yeatman-Bertelot & Jarry 1991 and the second breeding atlas was Yeatman-Bertelot & Jarry 1994. Regional or country-wide bird books or field guides do not represent an "Atlas" even though they may be a valuable and necessary aid in compiling and preparing a Bird Atlas. The meaning of 'Atlas' is a "book of maps", and a Bird Atlas may be defined as a collection of as many maps as there are bird species in a given country, each map showing the distribution of a given species (in the Palearctic, usually nesting) occurring in the country, and usually being placed opposite a page with a detailed species account.

After 1976, several other Bird Atlases were published, especially in Fennoscandia where many ornithologists and other bird enthusiasts had already done the meticulous fieldwork and scientific recording of observations and had also published well-organized and easily available information in many bird books and field guides, all of which were necessary for the compilation of an Atlas.

In the present era of climate change and continuing widespread human-induced habitat change and destruction, bird atlases are of special importance for monitoring the change in bird behaviour, especially of migratory birds. The behavior of birds could be monitored by atlases as they map distributions, for many distribution changes can be related to a multitude of numerous different factors, some related to such as climate change, some to habitat change, competition and predation. The main aim of early atlases had been to depict the breeding distribution areas of bird species within a country, but tended to lack quantitative information on breeding pairs of bird species or even estimates of population sizes. An early exception was Bekhuis *et al*. 1987 (Netherlands: the second Dutch atlas was

Hustings & Vergeer. 2002), and although the Finnish Atlas (Hyytiä *et al.* 1983) had not included this aspect because the data were incomplete, Koskimies (1989) remedied this deficiency as an Appendix. *The EBCC Atlas of European Breeding Birds* (Hagemeijer & Blair 1997) included bar-chart presentations of the largest populations, country-by-country, but this Atlas avoided going into detail because it was intended to be supplemented by two BirdLife International books then being finalized, namely Tucker & Heath 1994 and Heath *et al*. 2000. The latter was superseded by Burfield & van Bommel 2004. Most national bird atlases in Europe have covered bird populations extensively, *e.g*. Geister 1995 (Slovenia), Purroy 1997 (Spain), Schmid *et al*. 1998 (Switzerland) and Iankov 2007 (Bulgaria). In the USA, the early promise of Price *et al.* 1995 has not been followed up on a national basis.

There is already ample evidence of shifts in distribution northwards of many migratory birds and especially waterbirds; for example see Maclean *et al*. 2009, the introductory material in Huntley et al, 2007 and narrative summaries in such as www.birdlife.org/climate change. Large-scale changes in environmental circumstances would inevitably require constant revision of bird atlases to ensure their validation as necessary tools for monitoring climate and habitat change.

Here I have focused on a model from a Fennoscandian country, Finland, to suggest an exemplar process for the preparation of a Bird Atlas. Finland is a small in relation to Iran, which is about five times larger, but it has *c.* 250 breeding species, a total of 456 species having been recorded. Because the Finns have long been a nature-loving people and educated to a high standard, Finland has produced numerous biologists, but especially ornithologists; it also has many dedicated amateur bird enthusiasts who from high school age are accustomed to participation in regular nationwide bird counts. By the 1980s, these mostly volunteer forces were able to record, species by species (many of which occur in Iran), over six million birds spending the summer in Finland. The Finns number only five million people.

METHODOLOGY AND RESULTS

In 1972 the idea for the first Bird Atlas of Finland (BAF) (Hyytiä *et al.* 1983) was born from the perceived need to elucidate in detail the distribution of birds occurring there during the summer, *i.e.* the nesting season. By this time, the great increase in enthusiasm for bird-watching had resulted in the creation of many academic associations and active local non-governmental organisations (NGOs), all of which in 1973 became coordinated within the Union of Ornithological Associations [In Finnish: Lintutieteellisten Yhdistysten Liitto] of Finland. The first Finnish bird atlas became their first joint project for 1974–79. Because many distribution areas change constantly, a second Bird Atlas project was carried out ten years later in 1986–89 (Väisänen *et al*. 1998). Another monitoring project (2006–2010) is being carried out (Fig.3) along with the current Third Finnish Bird Atlas project (2009–2012) which is running online as an interactive project on www.lintuatlas.fi (in Finnish and Swedish). This site also collates bird observations from individuals; this aspect is a service by the Finnish Museum of Natural History (see also www.fmnh.helsinki.fi/english/).

Since the 1980s, many other bird atlases have been published in other countries. Some have covered an entire country (*e.g.* UK, USA, France, The Netherlands and the Fennoscandian countries), but others have been regional in scope; these results are often now available on the Internet. Many recent interactive projects recruit online participatory local observers, or "atlasers", such as the Bird Atlas 2007-11 project for Britain and Ireland, run by the British Trust for Ornithology via www.bto.org/birdatlas/. The menus on this website show how the online infrastructure works and presents the results so far. The current UK Bird Atlas 2007-11 also is a comprehensive and interactive (on-line) project that will map the abundance and distribution of birds in Britain and Ireland during the breeding season and winter. It also employs the latest technical aids and techniques (Timed Tetrad Visits, Roving recorders) to find out changes in the distribution since the last breeding (1968–72, 1988–91) and winter (1981–84) atlases. Other similar projects are SABAP2 (South

African Bird Atlas Project 2) on www.sabap2.adu.org.za., and the interactive EBCC Atlas on a link from www.ebcc.info/atlas. Many others can be accessed through Google with the entry "bird atlases").

In Finland in 1974, the first step was to select the top management committee to control the implementation of the atlas project. This committee consisted of four professors of ornithology, each one with considerable accomplishments in the study of the birdlife of Finland; one acted as the chief organizer of BAF activities.

The map of Finland was divided into 23 areas, each with a Regional Coordinator who was well-acquainted with the birds of his or her region. Some of these coordinators were university professors and all were trained ornithologists or well-known birders in their given area. They were often very active and offered useful initiatives, such as establishing guidelines for their own area, some of which later were applied to the whole country. The timing of this work coincided with the growing interest in birdlife, which meant that many competent amateur birders were available, some of whom became 'workaholics' in their allotted squares. Indeed, a few took over recording for as many as 100 squares (10×10 km). The participation by some 2000 voluntary data collectors in the survey was probably the most important factor in the successful realisation of the first BAF.

With this massive input, it was impossible in the analysis of the observations to estimate accurately the total number of days and hours spent in fieldwork. Of the 400,000 observations received, many were repeat counts that had to be regularized and so only a quarter of a million (250,000) records from 1,410 participants passed the rigorous initial checks for final acceptance for the Atlas.

The checking process required highly qualified specialists. Often an extra questionnaire had to be sent out by the Regional Coordinator" to clarify uncertainties, especially in the case of special or rare species, or to verify nesting periods. Of the 250,000 records, 95.7% (234,235 records) were used in the final BAF.

In addition, use was made of reliable earlier records of bird counts and sightings. All relevant publications on nesting birds were consulted, especially for records of rare species, taking into account that the distributions of birds often vary with time.

These sources comprised 4.3% of the records and included Galliforme chick counts, ringing records for nestlings, waterbird archives, airborne counts of waterbirds and general publications about birds.

Initially, a suitable strategy had to be developed to implement the main aim of the project – the determination of the nesting sites of all bird species in Finland. In Europe, distribution studies based on the 'square method', a uniform grid system, had long been conducted in botany, but in ornithology this approach had not been undertaken before the 1960s. For the BAF, a methodology was developed based largely on the experience gained from respective data-gathering UK and Swedish efforts for Bird Atlases that had employed the 'square method'.

THE FOUR STAGES OF A NATIONAL BIRD ATLAS

A. Atlas design and layout and the data-collection effort

A.1. Selection of the map scale and the size of the squares comprising the map

The British and Irish Atlases of wintering and breeding birds used the British and Irish National Grids, and recorded presence or absence in each 10×10km grid square. The choice of 10×10 km squares in a unified grid system would allow access to resources if correlated coordinates were taken into use, although such correlated maps were not always available, and would be adaptable to the scale (50×50 km) of the then planned European Atlas. Thus for the BAF map (scale 100 km/cm) 3,856 squares were drawn. The 5-year period initially allotted for field work was finally stretched to six years due to the difficulty in obtaining adequate observations from the remotest areas, where specialist teams often had to be sent to collect the data. The EBCC Atlas (Hagemeijer & Blair 1997) uses the Universal Transverse Mercator (UTM) grid, and records presence or absence in each 50×50km grid square (Fig.1). In Finland, the breeding bird species are mapped in atlas grid

cells 10×10 km in size, *i.e.* there are *c.* 3,900 atlas grid cells in the 380,000 sq km country. The Atlas of Southern African Birds (Harrison *et al.* 1997) plots all records on the basis of a 15'×15' ("quarter-degree") grid, except in Botswana, where the national atlas scheme used a 30'×30' ("half-degree") grid. Using the 'half-degree' grids, a regional squared map was also produced for the project on the Atlas of Breeding Birds of Arabia (ABBA), considering Saudi Arabia, Yemen, Oman, UAE, Bahrain, Qatar and Kuwait (Fig. 2). Therefore, geographically-based maps are preferred in order to produce integrated maps for larger scales in the future. Meanwhile, the size of a region, country or province will usually determine the unit of the squared map. In a printed atlas, the larger the size of its maps, the smaller the geographical units that can be accommodated. For the breeding bird species in the BAF, the grid cell size chosen was 10×10 km (Ville Vepsalainen 2010, pers. comm.; Fig. 3).

Type of atlas required The aim of an atlas determines the fieldwork or research needed. Bird atlases fall into several categories. While they may be general (national) or regional, they may be breeding atlases (*e.g.* Europe; Hagemeijer & Blair 1997, Interim Atlas of the Breeding Birds of Arabia (ABBA, Jennings 1995: the final version will be published in late 2010), Britain and Ireland (Sharrock 1976), wintering atlases (*e.g.* Lack 1986, Britain and Ireland), atlases that address a specific group of birds (*e.g.* Delany *et al.* 2009; waders), or are derivative (Holloway 1996; historical) or predictive (Huntley *et al.* 2007; climatic).

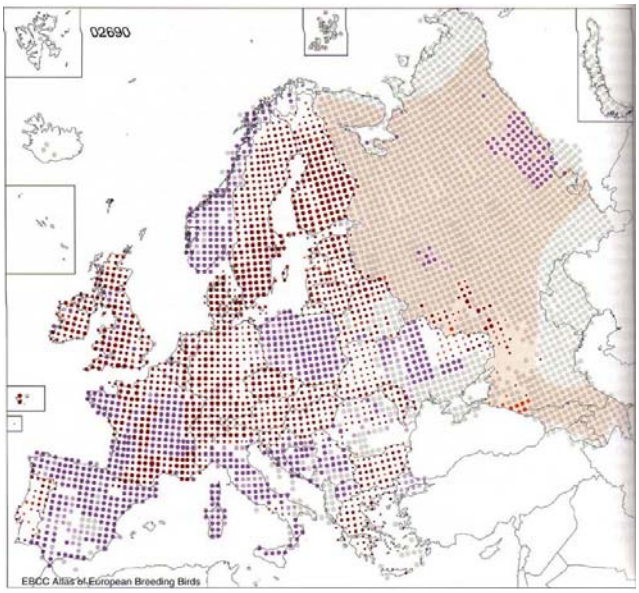


Figure 1. Map of Sparrowhawk *Accipiter nisus* in the EBCC Atlas (Hagemeijer & Blair 1997). Key to symbols:

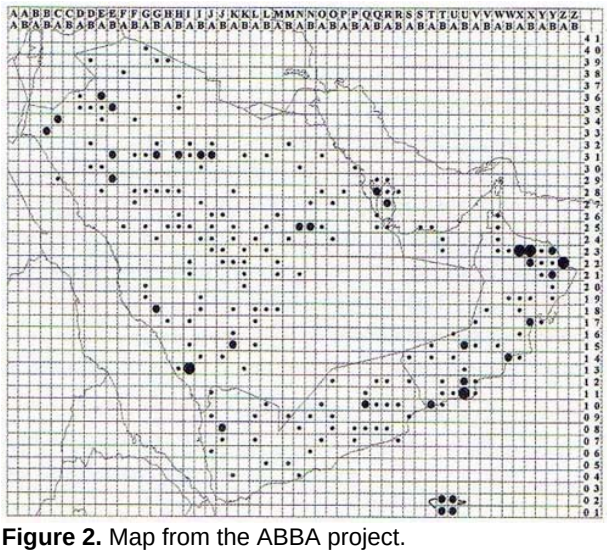
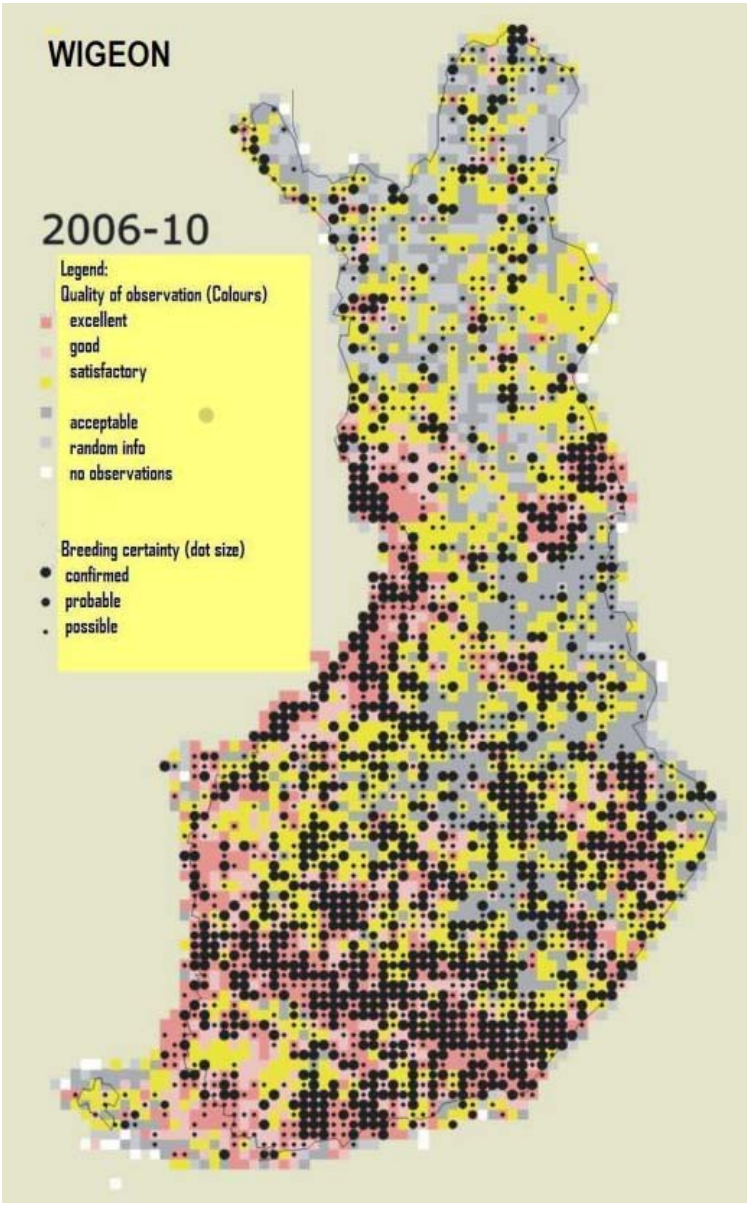


Figure 2. Map from the ABBA project.



Figures 3. Map of Eurasian Wigeon *Anas penelope* from Finland (2006–2010) inter-atlas project.

A.2. The fieldwork task: duration in years, survey seasons and fieldwork-days per square

Apart from historical atlases, general atlases usually consider the current status of bird species with respect to two/or three decades, but may include older records (*e.g.* Iankov 2007, Bulgaria). General atlases are compiled from year-round records, and so the occurrence of a species in square may be recorded, but unless the species' status is known, whether a record is of a passage migrant or of a rare species is somewhat uncertain.

A.3. The numbers of people on survey work

Observer density is related first to the spatial distribution of the human population and to the topography to be surveyed, but also to how proficient the observers are. In Finland, volunteer forces continue to participate in the ongoing atlas; in the 2006–2010 period, *c.* 2000 birdwatchers have entered observations in the atlas database. However, only about 100–200 comprise the very active volunteers who have collected *c.* 80–85% of all the observations (so far, atlas observations total *c.* 900,000). This reflects the sad circumstance that most birdwatchers nowadays are not interested in censuses of breeding birds. Most birdwatchers will probably be spending the limited migration period logging migrants or travelling many kilometers to see publicized twitching rarities (Ville Vepsalainen 2010, pers. comm.).

B. Methodology

B.1. Field methodology: bird observation techniques and count methods

The recording tables and sheets to be used for observations need to be designed with care, containing adequate guidance information for users, yet on completion being capable of automated electronic handling. The facing sheet of the recording sheet contained a list of all the 136 commonly occurring birds, while the rarer species were recorded on the back. Guidance information included a list of observation criteria (PV indexes) for recording during the nesting season the nesting status (PV, a Finnish abbreviation), ranging from possible (categories 01–04) to proven (13–20). This system was derived from the earlier A-D categories in of the "nesting certainty index", called, in the BAF "PesimisVarmuus indexit" (Hyytiä *et al.* 1983). For each atlas grid cell, the observer aimed to find as many breeding species as possible, within the agreed methodological constraints (*e.g.* number of

visits, time limit per visit). Each observer had to submit regularly "summary sheets" to aid following up the progress of each individual's observations in the allotted squares. Summary sheets also helped Regional Coordinators and others in the checking process in validation of results. Consequently, for a map illustrating only breeding presence of, say, Common Chaffinch *Fringilla coelebs*, in each cell with a dot might contain a single breeding pair, or a host

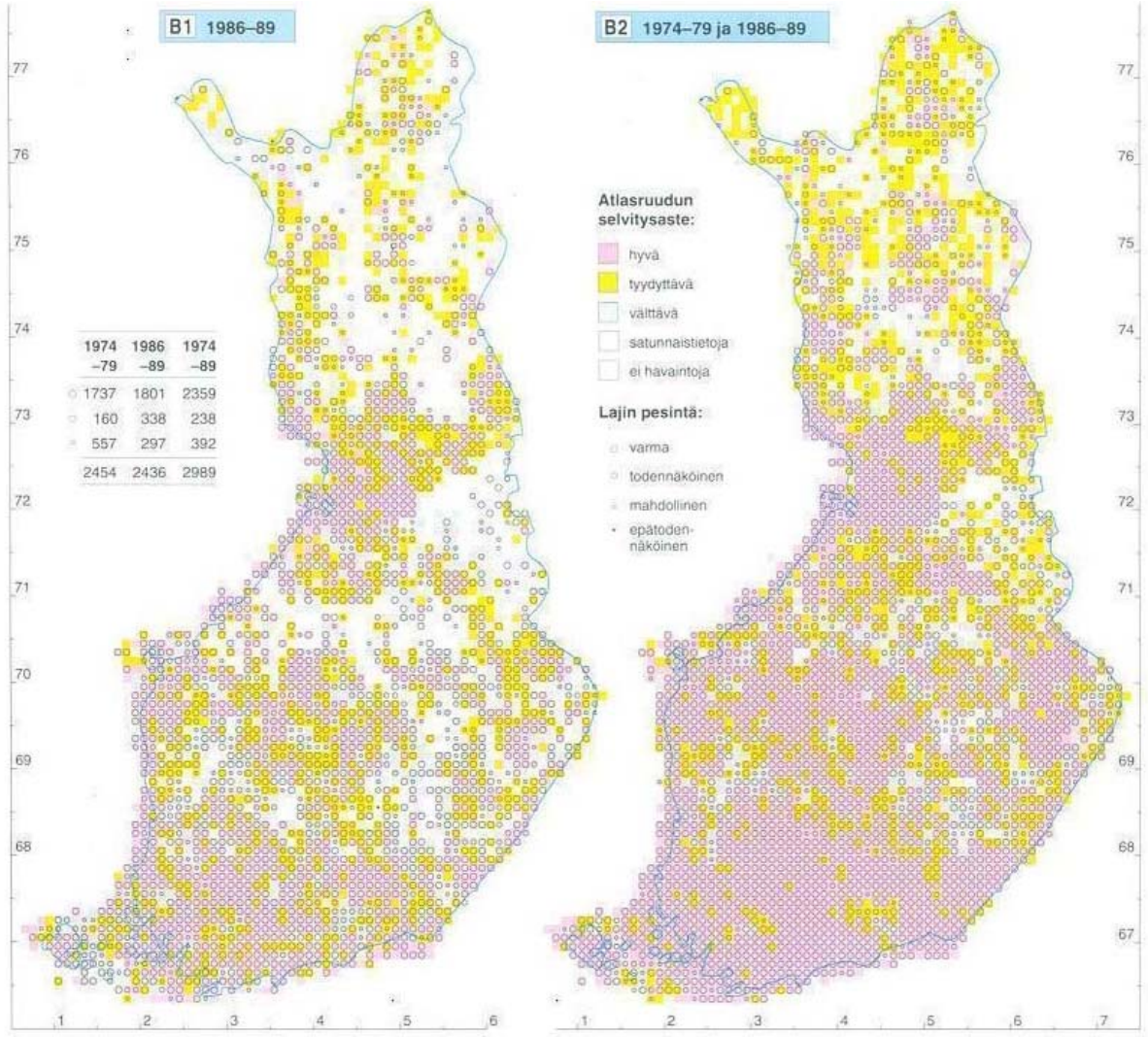
C. Validation and collation of data and the importance of feedback

The acquired material was gathered by the chief organizer in the top management committee and fed into the computer annually in this mostly summertime project, although on atlas projects that cover a greater part of the year, data entry follows a closer real-time schedule, whether monthly or continuously. The first phase in data-handling involves validating the reliability of the material, removing errors and subsequently correlating the data with previous material. The second phase sends the applicable statistics, maps and essential feedback information to the Regional Coordinators and the data collectors. Feed-back is very important, for it allows the observers in winter to see how their records were handled and to make corrections and compare them with other records. The commonest errors found during validation were of species identification and in nesting certainty index determination. Overall, the number of errors was very small.

D. Data analysis

The final analysis and checking process necessarily is tedious and time-consuming. It calls upon the expertise of the top management committee and requires Regional Coordinators to carry out repeat checks to ascertain how the results should be modified to conform to international standards. In certain cases there is a need to limit data presentation to ensure the protection of such as vulnerable species in line with agreed practice elsewhere. To this end, advice was sought from species protection workgroups to best protect the locations of rare and endangered species, thus preventing uncontrolled access to nesting sites. In general, the results of the first BAF proved to exceed expectations, given the sheer scale of the monumental effort by the dedicated participants. By its 1983 publication, it had taken ten years from the initiation of the project in 1973. The BAF distinguishes between confirmed breeding, probable breeding and possible breeding. The (Väisänen 1998) intermediate project resulted in a voluminous (5kg) comparative atlas which analysed changes in the distribution and abundance as well as changes in the density of species and the use of habitats and their changes (Fig. 4), and notably, dates back to 20–30 years ago when the environment was still relatively in a less threatened state.

To provide some kind of context in which to consider the consequences deriving from the BAF, it is useful to keep in mind that most European ornithologists and birdwatchers ('birders') are also interested in birds in other parts of the world, particularly in regions such as the Middle East and Africa where European migrant breeders migrate after the breeding season. Many competent expatriate birders and scientists have helped carry out studies in, and produce bird books about, countries across the world. The area around the Persian or Arabian Gulf has benefitted particularly (*e.g.* Gallagher & Woodcock (1980, Oman), Bundy *et al.* (1989, eastern Saudi Arabia), Hirschfeld (1995, Bahrain), Richardson (*e.g.* 1990, 2003, United Arab Emirates), Nightingale & Hill (1993, Bahrain), Aspinall (1996, 2010, UAE), Eriksen *et al.* (2003, Oman) and Gregory (2005, Kuwait)) and especially indirectly by encouraging the development of indigenous specialist knowledge. Indeed, a number of books have now been produced or translated into Arabic (*e.g.* Alfadhel (2005, Kuwait: in Arabic and English), Porter *et al.* (2006, Middle East: an Arabic translation by Sharif Jbour and Salim (2007, Iraq: in Arabic). In addition, the Ornithological Society of the Middle East, the Caucasus and Central Asia (OSME) is supporting the publication of national checklists that include the species' names in the appropriate local language. However, in Iran the only recent comprehensive publication on birds is by Mansoori (2008), and that is in Persian, while the first one, *The Birds of Iran*, published in 1975 with a couple of reprint editions after the revolution, has never been translated into English as planned.



	p/km²	%	p/km²	%	p/km²	%	p/km²	%	p/km²	%	p/km²	%	p/km²	%
Barren lake	12.9	(21.9)	9.2	(23.5)	5.1	(24.1)	3.2	(21.4)	1.1	(19.9)	0.5	(15.5)	0.3	(9.8)
Eutrophic lake	..	..	24.1	(24.6)	..	..	5.2	(12.8)	2.8	(14.9)	2.4	(6.1)	..	..
Bird lake I	47.1	(25.4)	43.0	(23.6)	18.8	(20.8)	8.1	(13.8)	2.9	(14.1)	2.3	(6.8)	3.2	(7.4)
Bird lake II	67.4	(16.5)	29.0	(19.4)	16.6	(21.6)	10.6	(13.8)	7.3	(9.6)	3.3	(8.6)	2.7	(9.3)
Barren lake	9.8	(15.9)	3.8	(7.3)	2.5	(9.7)	1.1	(10.3)	0.4	(3.9)	0.2	(4.3)	0.1	(2.9)
Eutrophic lake	..	..	..	..	..	..	..	..	1.0	(8.4)	..	..	..	..
Bird lake I	..	..	10.1	(11.5)	9.1	(10.3)	4.1	(9.4)	1.7	(6.1)	0.1	(1.1)	..	..
Bird lake II	..	..	..	..	..	..	3.5	(10.3)	5.6	(13.3)	1.6	(8.0)	..	..

Figure 4. Comparative distribution maps within a decade of Mallard *Anas platyrhynchos* from Finland (1974–79 superimposed on 1986–89).

Legend B1 & B2:

Quality of observation (colours)	**Breeding certainty (dot sizes, large to small)**
Lavender = excellent	confirmed
Yellow = good	probable (feasible)
Grey = satisfactory	possible
Light grey = acceptable	unlikely
White = no observations	

B3 Density (pairs/km$^{2)}$ and of abundance % share in lakes of various type and size

BIRD ATLAS IN IRAN

Currently, as we are informed that ample funding for realisation of a Bird Atlas in Iran has been made available to the Iran Department of the Environment (DOE), and in 2009 the project "Atlas of the Birds of Iran" was started. It is essential to develop a careful plan that will ensure that the results achieved are commensurate with international standards. Therefore, given the four stages of a national bird atlas in the outline example above, and given that all successful bird atlases mentioned above planned accordingly, before actually commencing this complex task in Iran, may we suggest a practical baseline map?

In 1980, Derek A. Scott used a 25×25 km grid (Fig. 5) based on a centre point of 32°00'N, 54°00'E to record and plot over 85,000 records for 432 species accumulated by himself, his colleagues in the DOE and visiting birdwatchers who were active in Iran between 1967 and 1978 (D.A. Scott pers. comm. to Editor). It was intended to add extract records from these maps and insert them into new maps so the latter included both older records and subsequent information. Unfortunately, this being an arbitrary grid meant that it was unlikely in retrospect to be suited to later, more formalized approaches. Mammalogists in the Department of the Environment in the mid-1970s were in favour of using a 15'×15' grid, and actually produced a base map (Fig. 6). However, it is not known if this grid was ever used to plot records (D.A. Scott pers. comm. to Editor). An obvious advantage of using a grid based on geographical coordinates is that it is easy to locate the appropriate grid square for any record for which the geographical coordinates are available (D.A. Scott pers. comm. to Editor). But the 15-minute grid size is rather small in relation to the overall size of Iran, a large country. The advantage of, say, a 30'×30' grid is that it produces four times fewer squares than the 15'×15' grid, but is the best proportionate option for a vast country like Iran. The larger the area to be covered, the larger the study squares have to be, both to be accommodated on printed page or on-screen, and to set the workload of the observers within practical limits. The workload is a function of the number of observers, the number of study squares, and the timescale of the data gathering. This suggestion meets the criteria mentioned earlier, that the size of a region, country and province determines the unit of the squares on the map and that geographically-based maps are the first preference so that derived-data integrated maps can be produced in ways that align with similar studies in-country and internationally.

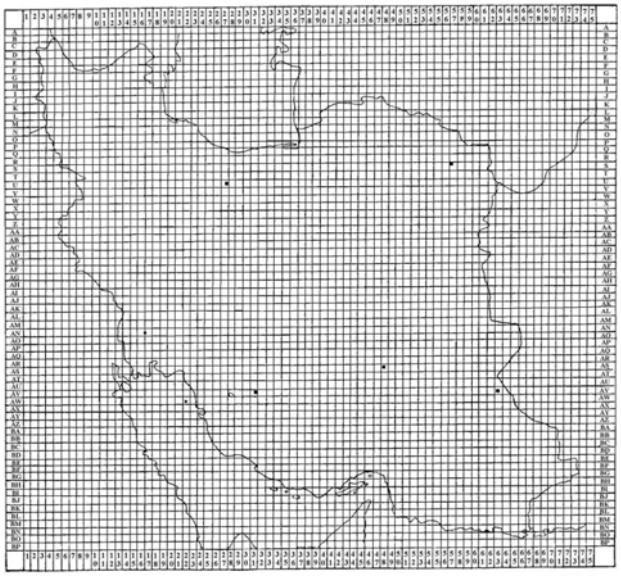


Figure 5. The 25X25km grid map of Iran designed by D.A. Scott.

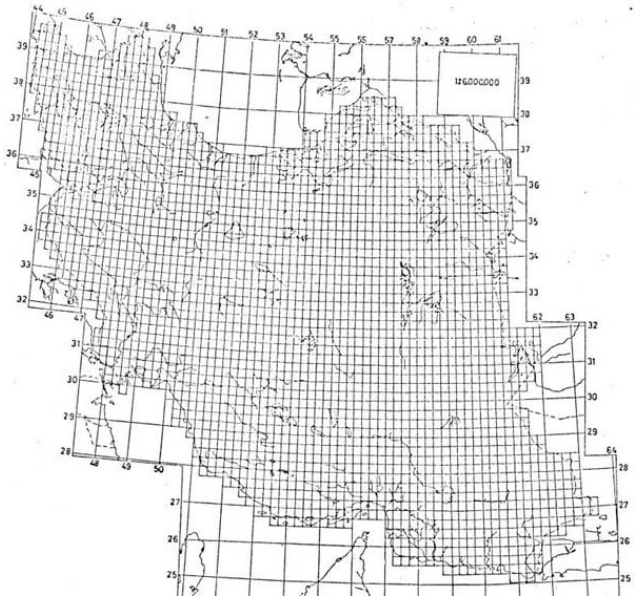


Figure 6. '15-minute' grid map of Iran designed by mammalogists in the Iran Department of Environment (DOE).

CONCLUSIONS

A Bird Atlas of any country is a vital scientific tool, firstly since it offers an opportunity to follow changes in distribution areas of birds, but also because if distribution changes can be related to habitat changes, the results identify where environmental protection is needed, because birds are good environmental indicators. For example, the Pan-European Bird Monitoring Scheme (derived from the EBCC Atlas: see www.ebcc.info/pecbm) provides hard data that helps governments shape sound environmental policies. Besides, each atlas is of international importance for the study of distribution patterns and routes of migratory birds, as sudden great changes, for instance in Scandinavia, would raise the alarm and indicate that something serious is happening, possibly in Africa where the birds migrate. But like birds, scientific knowledge is not constrained by borders and thus internationally active scientists usually cooperate for common scientific purposes. Thus development of international policies for the conservation of any given species and especially for the protection of endangered species depends on the accurate and detailed information that good Atlases provide. Especially today, they provide an indispensable tool for monitoring the crucial effects of climate change, *e.g.* Huntley *et al*. 2007, and Maclean *et al*. 2009.

From an international perspective, Iran is a very important country because of its rich birdlife and biodiversity. An Iranian Bird Atlas project to be carried out successfully, it will need:

1. A timescale to be decided that will permit adequate fieldwork and data-gathering groundwork
2. The necessary scientific know-how to be found from Iranian universities and other acknowledged experts for efficient oversight of the planning and progress of the project, prior to commencing the fieldwork.
3. Cooperation and coordination through international effort.
4. The involvement of dedicated NGOs whose work is inspired by a genuine love of nature.

It is timely and greatly important that the Bird Atlas project should be well-conceived and carefully planned in order to aid scientific efforts around the world to maintain and protect the living space of birds, which recognise only One Earth.

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