Atlas of Key Sites for Anatidae in the East Asian Flyway

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Yoshihiko Miyabayashi and Taej Mundkur

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1. Introduction

Anatidae (ducks, geese and swans) is a group of waterbirds that is ecologically dependent on wetlands for at least some parts of their annual cycle. Anatidae species use a wide range of wetlands, from the high arctic tundra, temperate bogs, rivers and estuaries, freshwater or saline lakes, and ponds or swamps, to coastal lagoons and inter-tidal coastal areas such as mud-flats, bays and the open sea. They also utilise man-made wetlands such as rice fields and other agricultural areas, sewage works, aquaculture ponds, and others. Wetlands on which these birds depend upon are usually highly productive habitats. Thus relatively small areas may support large concentrations of waterbirds. Wetlands are usually discrete and separated from each other by vast areas of non-wetland habitat. Wetlands are one of most threatened habitats in the world. In recognition of the importance of conserving wetlands for humans and nature, many countries are working towards the wise use of wetlands and increasing numbers are joining the Convention on Wetlands (Ramsar, Iran, 1971).

Many of the Anatidae populations migrate between wetlands in the northern breeding areas and southern non-breeding areas and in doing so, regularly cross the borders of two or more countries. Others move locally, within or across national boundaries largely in response to the availability of water. Thus they depend on a large network of wetlands throughout their range to complete their annual cycle. Migrations of Anatidae follow some similar general orientations, even if different species and populations have considerably different migration strategies. Within Asia, two major flyways are recognised for Anatidae. They are the Central - South Asian Flyway and the East Asian Flyway (Fig. 1).

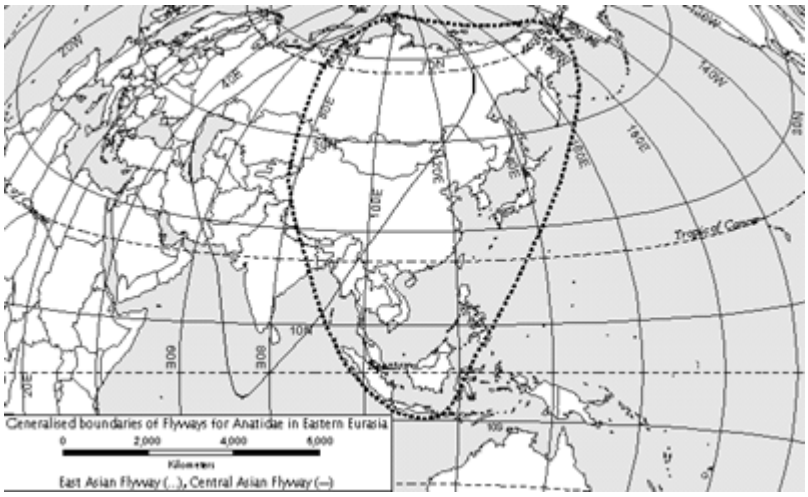

Figure 1. Two major flyways for Anatidae in Asia. Central - South Asian Flyway: solid line and East Asian Flyway: broken line.

Conservation of species depends on measures by individual countries to conserve the habitat and species themselves. In dealing with migratory species such as most Anatidae, effective conservation programs can greatly benefit from internationally coordinated initiatives. One initiative is the establishment of *Anatidae Site Network in the East Asian Flyway* currently being developed by Wetlands International. The *Network* is developed under the *Asia Pacific Migratory Waterbird Conservation Strategy: 1996-2000* (Wetlands International 1996) and is to be formally launched in conjunction with the 7th Meeting of the Contracting Parties of the Ramsar Convention in May 1999. Other international initiatives which will benefit Anatidae conservation include the Asian Red Data Book and Important Bird Area projects of BirdLife International. The Red Data Book is a compilation of information on threatened species while the Important Bird Area project will identify areas of importance for birds. Some of these areas will be important for Anatidae and conservation of these sites will serve to complement and extend the Anatidae Site Network.

Information on the network of key sites used by each Anatidae population is a basic requirement for the implementation of this initiative. This document aims to compile available information on key sites in the East Asian Flyway. *A Directory of Asian Wetlands* (Scott 1989) was the first attempt to collate information on important wetlands on a region-wide basis. Information for the *Directory* was collected simultaneously with the establishment of the Asian Waterfowl Census (AWC) programme. The AWC is an on-going internationally co-ordinated initiative of Wetlands International that aims to collect information on waterbirds and wetlands every January through nationally run volunteer-based networks. An analysis of the first five years of information collected by the AWC network (Perennou *et al*. 1994) has provided the first opportunity of examining information on important sites for waterbirds on a species basis in Asia. The AWC programme has continued to collect information since this analysis. The centralised database maintained by the Census has served as a basis for identifying key sites in this publication. Additional information, both published and unpublished, has been collected from experts in the region.

The aim of preparing the Atlas is to rapidly collate and disseminate information on the Anatidae in the East Asian Flyway. The objectives of the present document are intended to contribute to the conservation efforts of Anatidae in the East Asian Flyway by:

- delineating units of population for each Anatidae species, as a basis for the application of conservation measures,
- providing estimates of the numbers of individuals in each population unit, and
- identifying the key sites for each population.

There will be gaps in the information provided in this Atlas, primarily due to lack of information on many areas and species and also due to existing unpublished and published information not being found or made available during its compilation. It is hoped that the publication of this document will receive constructive comments and criticisms from experts in the field, stimulate the provision of additional data, and encourage further research and surveys targeted at filling in the many gaps in our knowledge. We can expect future editions to be more comprehensive. This Atlas focuses on the East Asian Flyway and does not covers the Central Asian Flyway and populations restricted to Southeast Asia - Australasia. On the basis of information collated from the other regions and updates received after the publication of this Atlas, it is proposed that an Atlas to cover the whole of Asia will be developed by the Wetlands International (Annex I provides more information on the proposed project).

Wetlands International has published an Atlas of Anatidae Populations in Africa and Western Eurasia (Scott & Rose 1996). It provides a comprehensive review of information and definitions of flyways, biogeographic populations, selection of key sites, and others. In order to maintain consistency of approach between the two publications, for the East Asian Atlas, we have taken the liberty of quoting information from Scott & Rose (1996).

2. Identification of population limits

A 'biogeographical population' comprises a discrete unit with a clearly defined range linking the breeding and moulting area to the terminal non-breeding (wintering) area, and interchange of individuals between different populations of the species remains at a low level. 'Biogeographical populations' in the East Asian Flyway are treated as separate units in this Atlas and are listed in Table 1. Several types of 'populations' are recognised (examples from the Flyway are provided in parentheses):

- the entire population of a monotypic species (*e.g*. *Anser cygnoides*, *Anas formosa* and *Aythya baeri*);
- the entire population of a recognised subspecies (*e.g*. *Anser fabalis serrirostris* and *Anas poecilorhyncha* subspp.);
- a discrete migratory population of a species or subspecies, *i.e*. a population which rarely if ever mixes with other populations of the same species or subspecies (none in the case of the East Asian Flyway);
- a 'population' of northern hemisphere birds which spends the winter in a relatively discrete portion of Eastern Eurasia. In many cases, these 'populations' may mix extensively with other populations on the breeding grounds, or with sedentary populations of the same species during the migration seasons and/or on the wintering grounds (*e.g*. many of the *Anas* species widespread in the Palearctic); and
- a regional group of sedentary, nomadic or dispersive species with an apparently rather continuous distribution and no major gaps between breeding units sufficient to prohibit interchange of individuals during their normal nomadic wanderings and/or post-breeding dispersal (*e.g*. *Dendrocygna javanica*, *Sarkidiornis melanotus* and *Nettapus coromandelianus*).

In order to identify 'biogeographical populations' of a species, it is necessary to delineate population boundaries based on the movements of individuals and other migration studies. A study of the movement of individuals normally relies on identifying individuals using a variety of standard marking techniques: banding (ringing) with metal bands and/or colour bands/flags, neck collars, nasal tags, radio/satellite transmitters, etc. Pioneering attempts to identify Anatidae populations in Eurasia were made by Isakov (1967, 1970) and Shevareva (1970). Information for Western Eurasia is summarised in Scott & Rose (1996).

There is no recent comprehensive review that summarises information on the status, migration routes and populations of Anatidae in Asia. Over the last 50 years or so, information on migratory routes of Anatidae in Eastern Eurasia has been collected through a number of national banding programmes, many of which originated from the large co-ordinated MAPS programme conducted between 1968 and 1971 (McClure and Leelavit 1972, McClure 1974). The work of the Bird Banding/Ringing Centres in Russia, China and Japan (Yamashina Institute for Ornithology) in particular has been instrumental in collecting and publishing a large volume of data on movements of Anatidae (*e.g*. Kistchinski 1979, BMRC-YIO 1985, NBBC-PRC 1987, Bianki &

Dobrynina 1997). Nevertheless, there remain many gaps in the information on the migration routes and population boundaries for all species.

The concept of 'populations' based on the main wintering regions follows recommendations of Atkinson-Willes (1976) and Atkinson-Willes *et al*. (1982). This concept was first applied in Eastern Eurasia by Perennou *et al*. (1994). *Waterfowl Population Estimates* (Rose & Scott 1994, 1997) has largely followed Perennou *et al*. (1994) but has also recognised some more 'populations' not previously considered.

This Atlas also largely follows Perennou *et al*. (1994) and Rose & Scott (1997) and incorporates some suggestions from Anatidae experts in the flyway. These changes are covered in the species account of *Anser caerulescens, Branta bernicla* and *Mergus merganser*.

Table 1. Anatidae populations in the East Asian Flyway. Population sizes, population trends and recommended thresholds for use in 1% criterion by the Ramsar Convention and the Anatidae Site Network.

The 1% thresholds in parentheses are provisional numerical criteria for use in this Atlas, and are not yet intended as official 1% levels for the identification of sites of international importance. Population trends follow Rose & Scott (1997) and a blank indicates the absence of any information.

Species or subspecies	Population	Population Estimates		Threshold used to select key sites
		Size	Trend	
Dendrocygna bicolor	Southern Asia / Myanmar	20,000	Decreasing	200
Dendrocygna javanica	Eastern / Southeastern Asia	100,000-1,000,000	Decreasing	(5,000)
Oxyura leucocephala	Southern Asia (wintering)	300	Decreasing	3
Cygnus olor	Eastern Asia	1,000-3,000	Decreasing	20
Cygnus cygnus cygnus	Central Siberia / Eastern Asia	60,000		600
Cygnus columbianus jankowskii	Central Siberia / Eastern Asia	40,000		400
Anser cygnoides	Entire population: Eastern Asia	30,000-50,000	Decreasing	400
Anser fabalis middendorffii	Eastern Taiga (breeding)	50,000-70,000	Decreasing	600
Anser fabalis serrirostris	Eastern Tundra (breeding)	45,000-65,000	Decreasing	550
Anser albifrons	Eastern Asia	100,000-150,000	Decreasing	1,250

frontalis				
Anser erythropus	Eastern Asia	14,000	Decreasing	140
Anser anser rubrirostris	Eastern Asia	50,000-100,000		750
Anser indicus	China (wintering)	15,500-17,500		160
Anser indicus	Southern Asia / Myanmar (wintering)	16,800–18,900		180
Anser caerulescens caerulescens	Northern Far East / Eastern Asia	<300		3
Anser caerulescens caerulescens	Northern Far East / Alaska / California / Mexico	65,000		650
Anser canagicas	Entire population: Alaska / Northeastern Siberia / Aleutian Islands	45,000-80,000	Stable	600
Branta canadensis leucopareia	Eastern Asia	0		1
Branta bernicla nigricans	Eastern Pacific (wintering)	126,500	Stable	1,270
Branta bernicla nigricans	Eastern Asia	5,000		50
Tadorna ferruginea	Eastern Asia	50,000-100,000		(750)
Tadorna cristata	Eastern Asia	<50		1
Tadorna tadorna	Eastern Asia	100,000-150,000		1,250
Cairina scutulata	India - Myanmar	170		2
Cairina scutulata	Southeastern Asia	130		1
Cairina scutulata	Indonesia	150		2
Sarkidiornis melanotos melanotos	Southern / Southeastern Asia	6,000	Decreasing	60
Nettapus coromandelianus coromandelianus	Eastern / Southeastern Asia	25,000-1,000,000		(1,000)
Aix galericulata	China	20,000	Decreasing	200
Aix galericulata	Korea	5,000	Decreasing	50
Aix galericulata	Japan	40,000	Stable	400
Anas strepera strepera	Eastern Asia	500,000-1,000,000	Decreasing	(7,500)

Anas falcata	Entire population: Eastern Asia	500,000-1,000,000	Decreasing	(7,500)
Anas penelope	Southern Asia (wintering)	250,000	Increasing	2,500
Anas penelope	Eastern Asia	500,000-1,000,000	Decreasing	(7,500)
Anas platyrhynchos platyrhynchos	Eastern Asia	>1,500,000		(20,000)
Anas poecilorhyncha zonorhyncha	Eastern Asia	800,000-1,600,000	Decreasing	(12,000)
Anas poecilorhyncha haringtoni	Southeastern Asia	100,000-1,000,000		(5,000)
Anas luzonica	Philippines	2,500-10,000	Decreasing	(50)
Anas clypeata	Eastern / Southeastern Asia (wintering)	500,000-1,000,000		(7,500)
Anas gibberifrons gibberifrons	Indonesia	10,000-25,000	Stable	(150)
Anas gibberifrons albogularis	Andaman Islands	500-1,000	Decreasing	8
Anas acuta acuta	Eastern / Southeastern Asia (wintering)	500,000-1,000,000	Decreasing	(7,500)
Anas querquedula	Eastern / Southeastern Asia (wintering)	100,000-1,000,000		(5,000)
Anas formosa	Entire population: Eastern Asia	210,000		2,100
Anas crecca crecca	Eastern / Southeastern Asia	600,000-1,000,000	Decreasing	(8,000)
Marmaronetta angustirostris	Southern Asia	5,000	Increasing	50
Netta rufina	Southern / Central Asia	25,000-100,000	Decreasing	(500)
Aythya ferina	Eastern / Southeastern Asia	600,000-1,000,000		(8,000)
Aythya nyroca	Southern / Eastern / Southeastern Asia	10,000	Decreasing	100
Aythya baeri	Entire population: Eastern / Southeastern Asia	10,000-20,000	Decreasing	150
Aythya fuligula	Eastern /	500,000-1,000,000		(7,500)

	Southeastern Asia			
Aythya marila mariloides	Eastern Asia	200,000-400,000		(3,000)
Somateria mollissima v-nigra	Northwestern North America / Eastern Siberia / Bering Sea	130,000-200,000	Decreasing	1,700
Somateria spectabilis	Eastern Asia			
Somateria fischeri	Eastern Siberia / Alaska	140,000-160,000	Decreasing	1,500
Polysticta stelleri	Eastern Asia / Alaska	180,000	Decreasing	1,800
Histrionicus histrionicus pacificus	Western Pacific	25,000-100,000		(500)
Clangula hyemalis	Eastern Asia	500,000-1,000,000		(7,500)
Melanitta nigra americana	Eastern Asia	100,000-1,000,000		(5,000)
Melanitta fusca stejnegeri	Central / Eastern Asia	600,000-1,000,000		(8,000)
Bucephala clangula clangula	Eastern Asia (wintering)	50,000-100,000		(750)
Mergellus albellus	Eastern Asia (wintering)	25,000-100,000		(500)
Mergus serrator serrator	Eastern Asia (wintering)	25,000-100,000		(500)
Mergus squamatus	Entire population: Eastern Asia	2,000-4,000	Decreasing	30
Mergus merganser merganser / orientalis	Southern Asia (wintering)	2,500-10,000	Stable	60
Mergus merganser merganser / orientalis	Eastern Asia (wintering)	50,000-100,000		(750)

3. Methods

3.1 Regional scope

The Atlas covers the arctic region of Siberia to the Far East of Russia and Alaska in the United States of America, south through Mongolia, People's Republic of China, the Korean peninsula, Japan, Southeast Asia and the Philippines.

3.2 Taxonomic scope, treatment and nomenclature

Species and populations of Anatidae in the East Asian Flyway refers to the birds that breed and migrate within Eastern Asia during their annual cycle (Table 1). The breeding range, staging and moulting sites and non-breeding areas of several Anatidae populations extend into Central and Southern Asia in the west and into North America in the east and these populations are included. All Australasian species and populations are excluded. Species which occur in Eastern Eurasia only as rare vagrants or stragglers from other regions are also excluded.

Although listed in Table 1, no account is provided in the Atlas for:

- the only endemic species *Tadorna cristata* that is considered close to extinction (or Critically Endangered);
- marginal populations that extend from Central - South Asian Flyway: *Dendrocygna bicolor*, *Oxyura leucocephala*, *Marmaronetta angustirostris* and *Netta rufina*; and
- mostly sedentary species or populations of South and Southeast Asia such as *Cairina scutulata*, *Anas luzonica* and *Anas gibberifrons*.

Species and populations which occur in the region only as a result of introductions by man (*e.g.* a feral population of *Cygnus olor* in Japan) have been excluded.

Taxonomic treatment at species level follows Sibley & Monroe (1990, 1993). Information on subspecies has been derived from a number of sources, the principal references being del Hoyo *et al*. (1992) and Madge & Burn (1988). Common names closely follow Sibley & Monroe (1990).

3.3 Data sources

A large amount of new count information originates from the Asian Waterfowl Census (AWC). The AWC has been in operation since 1987. The programme is currently co-ordinated by Wetlands International - Asia Pacific and prior to 1996 was co-ordinated by the International Waterfowl and Wetlands Research Bureau and Asian Wetland Bureau. The data is stored in a central database and data for 1987-1996 has been reassessed for this project to identify key sites for Anatidae. The Environment Agency of Japan has offered the data of national annual counts of Anatidae in January 1997 for assessment of this project.

A large number of experts have offered additional data and reports. An attempt to locate information from literature has yielded additional data. However, the limited time available for this project has not permitted a comprehensive review of literature, adequate consultation and peer review of the information collated.

All these data have been stored in a database for this project and have been used for the identification of key sites. Details of the structure of the database are provided in Annex I.

3.4 Population estimates

The estimates of populations used in this Atlas are identical to those published in the second edition of *Waterfowl Population Estimates* (Rose & Scott 1997), unless stated otherwise. Where a population estimate differs from that in Rose & Scott (1997), justification for a new estimate is given in the species text under the heading 'Population size'. All population estimates and the 1% criterion derived from them are given in Table 1.

In most cases, estimates of total size of populations are based on the population in the non-breeding period. In cases where the total population size is derived from an estimate of the breeding population, the number of individuals in the population is calculated as three times the number of breeding pairs. This formula has been proposed by Meininger *et al*. (1995), and is adopted by Rose & Scott (1994, 1997). The formula has been tested for *Anser indicus* in this Atlas.

Some Anatidae populations in the East Asian Flyway have not been sufficiently covered by the Asian Waterfowl Census and other co-ordinated annual censuses. In these cases, population sizes have been provided in the form of a very broad range. Most of these population sizes are derived from published literature. A lot of new information has been contributed by Anatidae experts since the Action Plan for Anatidae workshop organised in Kushiro, Japan, in 1995. The 'provisional numerical criterion' for selection of sites in this Atlas has been set at 1% of the middle of the range, following Scott & Rose (1996). Thus, for example, the numerical criterion for a population estimated at between 100,000 and 1,000,000 would be 1% of 550,000, which when rounded off is 5,000.

3.5 Selection of key sites

The Ramsar Convention has adopted several criteria for the identification of wetlands of international importance. Criterion 3a states: "A wetland should be considered of international importance if it regularly supports 20,000 waterfowl." (Annex I to Recommendation 4.2, Montreux, Switzerland, 1990). This criterion refers to all waterfowl as defined by the Convention, including Anatidae. A preliminary list of key sites that support 20,000 or more individuals of Anatidae, comprising one or more species identified in the Project is presented in Annex II. The list includes sites identified on the basis of single or more counts and estimations of the number of single or several Anatidae species. These sites are presented in a map (also in Annex II).

Principles to identify key sites for individual species and populations of Anatidae have been laid out by Scott & Rose (1996). This Atlas follows similar criteria and a key site is selected on the following basis:

- A site is identified as being a key site of international importance for a particular population if:
    a. the average of the peak counts in the most recent five years of counts exceeds 1% level of the population.
    b. the 1% level has been exceeded in at least three of last five counts.
    c. the site regularly supports over 50 individuals (or 15 breeding pairs) of a globally threatened species or subspecies.
- The site is provisionally identified as key site for a particular population if:
    . the average of peak counts exceeds 1% level of the population but the site has been counted in fewer than five years.
    a. the 1% level has been exceeded in fewer than three of the last five years of counts.
    b. the 1% level has been exceeded in one or two years at sites which have been counted in fewer than five years.
    c. the site has been selected on any of the above criteria using a provisional numerical criterion based on a rough estimate of total population size.
    d. the site has been selected on any of above criteria where the first count was before last 10 years (*i.e.* before 1988 in this Atlas).
    e. the breeding sites are reported as important in existing literature.

In the table of key sites in each species account, the inclusion of a site is explained by an importance code (Table 2). Additional information on the criteria follows in this section.

Table 2. Selection criteria for key sites.

Importance code	Reason for selection
1	Five or more counts available between 1988 and 1997 with an average of the last five counts exceeding 1% of the population size.
2	An average of the last five counts exceeding 1% of the population size but the first of these counts is prior to 1988
3	Five or more counts available between 1988 and 1997 of which three or more exceed 1% of the population size, but the average count does not.
4	Three of the last five counts exceed 1% of the population size but the average does not and the first of these counts is prior to 1988.
5	Less than five counts are available but three counts have exceeded 1% of the population since 1988.
6	Less than five counts are available but three counts have exceeded 1% of the population, the first of these prior to 1988.
7	The site qualifies as a potential harsh weather or drought refuge only.
8	At least one count exceeding 1% of the population size but less than three

	of the last five counts available between 1988 and 1997 reach this value and the average of the last five counts is less than 1% of the population size
9	Same as for code 8, except that the last five counts started prior to 1988
10	Less than five counts available and less than three counts exceeding 1% of the population size but the average of all counts exceeds 1% of the population size.
11	Less than five counts available of which one or two exceed 1% of the population size but the average of all available counts does not. This code is also used for concentrations of globally threatened species thought to be important despite being below 1% of the population size, and for concentrations of very large populations that exceed 20,000 individuals yet fail to exceed 1% of the population size.

i) The 1% criterion

The basic criterion used for selection of key sites in this Atlas is the 1% criterion. This is one of the Ramsar Convention Criteria developed for the identification of wetlands of international importance for Ramsar Sites. Criterion 3 of the Convention states: "A wetland should be considered internationally important if: (c) where data on populations is available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl" (Annex I to Recommendation 4.2, Montreux, Switzerland, 1990). This 1% level is applicable throughout the range of that population and at any time of the year.

It is essential that the term 'regularly' be defined to enable proper application of this criterion. There have been a series of discussions and recommendations on this subject, *e.g*. Atkinson-Willes *et al*. (1982) for Eurasia and Perennou *et al*. (1994) for the Asian region. This Atlas follows Perennou *et al*. (1994) in the selection of key sites and identifies sites that support:

- more than 1% level of apopulation in at least 3 of last 5 years, or
- more than 1% level of apopulation as the mean of last 5 years.

ii) Criteria for globally threatened species

The Ramsar Convention has adopted a criterion (2a) that relates specifically to threatened species or subspecies of plants and animals and states: "a wetland should be considered internationally important if it supports an appreciable assemblage of rare, vulnerable or endangered species" (Annex I to Recommendation 4.2, Montreux, Switzerland, 1990). The IUCN Red List provides the global standard for 'rare, vulnerable and endangered species' (but does not consider subspecies). The most recent edition of the Red List was published in 1996 (IUCN 1996). Green (1996) has published a list of globally threatened Anatidae taxa at the species or subspecies level. Data for Eastern Eurasian populations is summarised in Table 3.

In addition to the sites that support more than 1% of a population of a globally threatened species or subspecies, sites that regularly support an 'appreciable assemblage' of individuals of some of these species or subspecies are also included in the list of key sites in this Atlas. There has been no guidance on the interpretation of the words an 'appreciable assemblage'. For species that are highly gregarious outside the breeding season, application of the 1% criterion alone will select sites holding the great bulk of the population, and there may seem to be little need for an additional, lower numerical criterion. For species with highly dispersed distribution, strict application of the 1% criterion will select only a small number of 'super' sites. Scott & Rose (1996) have included sites that regularly support over 50 individuals (or 15 breeding pairs) of a globally threatened species in the list of sites identified as being of international importance.

For the purposes of the present Atlas, levels below 1% have been selected provisionally for globally threatened species based on the ecology and biology of the species concerned: *Aythya nyroca*, *Aythya baeri*, *Polysticta stelleri* and *Mergus squamatus*.

Table 3. Threatened and near-threatened species of Anatidae in Eastern Eurasia (as listed by IUCN 1996 and Green 1996). An asterisk mark indicates the species or subspecies for which key sites supporting an 'appreciable assemblage' were selected in this Atlas.

English name	Scientific name	IUCN (1996)	Green (1996)
White-headed Duck	*Oxyura leucocephala*	Vulnerable	Vulnerable
Swan Goose	*Anser cygnoides*	Vulnerable	Vulnerable
Middendorf's Bean Goose	*Anser fabalis middendorfi*	-	Vulnerable
Thick-billed Bean Goose	*Anser fabalis serrirostris*	-	Vulnerable
Lesser White-fronted Goose	*Anser erythropus*	Vulnerable	Vulnerable
Aleutian Canada Goose	*Branta canadensis leucopareia*	-	Vulnerable
Crested Shelduck	*Tadorna cristata*	Critically endangered	Critically endangered
Indonesian White-winged Duck	*Cairina scutulata scutulata*	Endangered	Endangered
Indo-Malaysian White-winged Duck	*Cairina scutulata leucopterus*		Endangered
Mandarin Duck	*Aix galericulata*	Near-threatened	not listed
Philippine Duck	*Anas luzonica*	Near-threatened	Vulnerable
Andaman Teal	*Anas gibberifrons albogularis*	Critically endangered	Critically endangered
Baikal Teal	*Anas formosa*	Vulnerable	Vulnerable

Marbled Teal	*Marmaronetta angustirostris*	Vulnerable	Vulnerable
Salvadori's Duck	*Salvadorina waigiuensis*	Vulnerable	Vulnerable
Ferruginous Duck *	*Aythya nyroca*	Vulnerable	Vulnerable
Baer's Pochard *	*Aythya baeri*	Vulnerable	Vulnerable
Spectacled Eider	*Somateria fischeri*	Vulnerable	Endangered
Steller's Eider *	*Polysticta stelleri*	Vulnerable	Vulnerable
Scaly-sided Merganser *	*Mergus squamatus*	Vulnerable	Endangered

iii) Key sites for breeding birds

The 1% criterion is applicable year round, thus any site which supports 1% of a population during the breeding season is included in this Atlas. There has been considerable discussion (see for example Scott & Rose 1996) on the difficulties in selecting key breeding areas on the basis of the 1% criterion. This is especially relevant to the northern latitudes and in arid regions where many species breed in low densities. Information on the breeding areas of species in the East Asian Flyway is incomplete. Breeding sites identified as important on the basis of numerical data in the literature are provisionally included in the list of key sites.

4. Species Accounts and Maps

4.1 Species accounts

The species accounts contain information under the following headings:

Classification: a note on the species and subspecies, with IUCN category for the threatened taxa listed in IUCN Red List (IUCN 1996) and/or in Green (1996).

Distribution: a brief description of the world range of the species, with special emphasis on its distribution within Eastern Eurasia.

Movements: brief information on the movements of the species and special emphasis on its migration in Eastern Eurasia, as deduced from banding and migration studies. This information has been taken from published literatures, and no attempt has been made to undertake any new analyses of banding results.

Population limits: a description of those 'populations' of the species which should be treated as separate units for conservation purposes. This is justified as far as possible on the basis of known movements of the species. In many cases, it is accepted that these 'populations' overlap extensively with other populations of the species, and cannot therefore be justified on biological grounds. Justification then rests on the desirability of separating the individuals in a species or subspecies into geographical units which are of a manageable size for conservation purposes.

Population size: an estimate of population size for each of the 'populations' identified in the foregoing section. Two types of estimates are presented: those which are considered to be sufficiently reliable to be used in the identification of sites of international importance of the Ramsar Convention and Anatidae Site Network on the basis of the 1% criterion; and those which are not. The latter, usually given in the form of a very broad range, are presented as 'best guesses' of population size, and are used to derive a 'provisional numerical criterion' for the identification of key sites for this Atlas. When the estimate follows that given in *Waterfowl Population Estimates* (Rose & Scott 1997), reference is made to the original source of the estimate. When the estimate differs from that given by Rose & Scott (1997), justification for the revised estimate is given in the ensuing text. In many cases, an attempt has been made to revise the estimate by compiling the most up-to-date information that has been contributed by Anatidae experts in the countries in the flyway.

4.2 Table of key sites

Information of key sites is provided on a species and population level. The table is listed for each country in order of approximate location from north to south, and in each country the order of sites is from north to south.

Information on key sites presented in the table is as follows:

- Site: The name is taken from the source of the data in most cases, while others follow *A Directory of Asian Wetlands* (Scott 1989). The name of a site may be confusing since there are different ways of naming a site in the English language;
- Co-ordinates: the approximate geographic centre of the site in degrees and minutes;
- Season: the time of the year during which the site is important for the population: wintering / staging / breeding / moulting;
- Population/Count: the number of individual counted or estimated; the data shown in the table is the highest number in the last <5 counts available;
- Period/Date: the period of data;
- Importance code: indicating the reason for its selection as a key site. The importance codes refer to the key site selection criteria in Table 2; and
- Ref: the source of data; where derived from the AWC database and the national count in Japan these are indicated as AWC / EAJcount, respectively. In some cases where different populations are recognised for a species, the column showing the population relevant to the site is added.

4.3 Maps

For each species included in this Atlas, a map is given showing the approximate limits of the populations as identified in the text. Population boundaries are solid lines if they are based on good biological data. If the boundaries are poorly known or have very little biological significance, they are represented by broken lines. Thus broken lines are often used to delineate the main breeding ranges of migratory species when there is known to be a considerable amount of overlap between different 'populations' on their breeding grounds.

Approximate boundaries of breeding ranges of species are indicated by a dotted line. This information has been taken from the existing published literature; the main sources are Cheng (1976, 1979, 1987), del Hoyo *et al*. (1992), Grimmett *et al*. (1998), Scott & Rose (1996) and Poyarkov, N. (*pers. comm*).

All key sites are plotted as solid circles. Details of the key sites are presented in the table of key sites in the species account. The exact location of a few sites listed in the table is not known and these are not plotted in the maps.

This document focuses on the East Asian Flyway, the regional scope of which is outlined in Section 3.1. However some species or populations have population limits or migration strategies that do not follow the two major flyways in Asia (see Figure 1). There are some species with a single population that covers a large area of Asia (*e.g*. *Aythya nyroca*). Some populations of other species extend outside the regional scope of this Atlas (*e.g*. *Anser indicus, Sarkidiornis melanotos*). Key sites for these populations are known to exist outside the regional scope of this Atlas, but they are not documented in this publication.

Lesser Whistling Duck
Dendrocygna javanica

Classification

Monotypic.

Distribution

Confined to Eastern Eurasia, breeding temperate to tropical altitudes. Breeding in Southern, Southeastern and southern Eastern Asia; from Pakistan, India, Sri Lanka, east to southern China, and south to Borneo, Sumatra and Java. Japan had a small population in the 19th century in the Okinawa Islands but it is presumed to be extinct (Takano & Kuroda 1969).

Movements

Mostly sedentary, except for northernmost birds breeding in China which migrate to lower altitudes to winter. Breeding birds in other areas move in relation to the availability of water.

Population limits

Perennou *et al*. (1994) recognized two wintering groups: (1) Southern Asia and (2) Eastern and Southeastern Asia, which has been followed by Rose & Scott (1994, 1997).

Population size

- **Southern Asia: 100,000-1,000,000 (Perennou *et al*. 1994). Provisional numerical criterion 5,000.**
  Rose & Scott (1997) estimated 100,000-1,000,000, following Perennou *et al*. (1994).
- **Eastern / Southeastern Asia: 100,000-1,000,000 (Perennou *et al*. 1994). Provisional numerical criterion 5,000.**
  Rose & Scott (1997) estimated 100,000-1,000,000, following Perennou *et al*. (1994).

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Thailand						
Nong Nam Khao N.H.A. (Ban Hung Dua)	N1646E10006	Wintering	9535	1988/89winter	5	AWC
Beung Boraphet	N1542E10015	Wintering	20800	1990/91winter	2	AWC
Nong Waeng Non-Hunting Area	N1535E10216	Wintering	5000	1988/89winter	10	AWC
Cha-Vak Lake	N1455E10004	Wintering	32000	1993/94winter	11	AWC
Bung Cha-Vak	N1430E10000	Wintering	16383	1994/95winter	11	AWC
Kasetsart University (Kampaengsaen)	N1350E10005	Wintering	9000	1989/90winter	10	AWC
Vittayalai Rajmongkol Hantra University		Wintering	9500	1994/95winter	11	AWC
Myanmar						
Mong Pai	N2000E09700	Wintering	8000	1994/95winter	11	AWC
Moyingyi	N1730E09635	Wintering	6328	1990/91winter	8	AWC
Kye-In		Wintering	5466	1990/91winter	11	AWC

Mute Swan
Cygnus olor

Classification

Monotypic.

Distribution

Palearctic; patchily distributed but locally common across temperate regions of the Palearctic, mainly between 40°N and 60°N, from western Europe to northeast China. In Eastern Eurasia, breeds in Lake Baikal region, Mongolia and northern China, and winters in China and Korea. The species formerly bred in southern Primorskii Krai in Russian

Far East in the beginning of the 20th century (Kostenko *et al*. 1989). It has been introduced into Japan, where there is a feral population of a hundred birds.

Movements

Truly wild populations mainly migratory; and spend the winter in more temperate latitudes. Feral populations mostly sedentary.

Population limits

Two wintering groups are recognised (Perennou *et al*. 1994): (1) Central Asia and (2) Eastern Asia.

Population size

- **Central Asia : 10,000-25,000 (Rose & Scott 1997). Provisional numerical criterion 150.**
  Rose & Scott (1997) estimated 10,000-25,000.
- **Eastern Asia: 1,000-3,000. 1% level 20.**
  Rose & Scott (1997) estimated <1,000, following Perennou *et al*. (1994). The most up-to-date population estimates or counts in the wintering range are: 1,000 (Lu 1995) or less than 3,000 (Zheng & Wang 1998) in China. There have been some records of wintering flock up to 41 birds in the Republic of Korea in 1989 - 1996 (Scott & Rose 1989, Perennou *et al*. 1990, Perennou & Mundkur 1991, 1992, Lopez & Mundkur 1997, Kim *et al*. 1996). Park, J-Y. (*pers. comm*. 1999) estimates the wintering population in the Republic of Korea as 40-60 birds. Japan has a feral population of 150 birds (average of 1992/93 - 1996/97 winters, WPD-EAJ 1997), which is not included in as the Eastern Asia population. Based on the information available, a revised total population of 1,000-3,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Mongolia						
Orog Nuur (Orok Nuur)	N4503E10045	Breeding	22	1962	11	Shiirevdamba 1997
Korea, Republic of						
Hwajinpo Lake	N3828E12826	Wintering	47	1992/93winter	11	AWC
China						
Ebinur (Aibi Hu)	N4455E08252	Breeding	108	1986summer	10	Zheng & Wang 1998
Sayram Hu (Sailim Hu)	N4435E08110	Breeding	100	-	11	Zheng & Wang 1998

Whooper Swan
Cygnus cygnus

Classification

Monotypic.

Distribution

Palearctic, breeds widely at northern latitudes, mainly between 50°N and 70°N, from Iceland to the Bering Sea, and winters south to western Europe, the Black and Caspian Seas and Eastern Asia. In Eastern Eurasia, it breeds from Siberia to Russian Far East, south to Mongolia and northern China. It winters in China, Korea and Japan. Nesting on Attu Island, Aleutians in Alaska, USA, was confirmed in 1996 and 1997 (Sykes & Sonneborn 1998, Michell 1998). A small population of <50 individuals winters on the Aleutian and Pribilof Islands, Alaska (Mitchell 1998).

Movements

Mostly migratory, wintering in temperate latitudes, with some remaining throughout the winter in Kamchatka, Russia, and the Aleutians.

Population limits

Only one population is recognised in Eastern Eurasia.

Population size

- **Central Siberia / Eastern Asia: 60,000. 1% level 600.**
  Rose & Scott (1997) estimated 30,000. However, the most up-to-date population estimates or counts in the wintering range are: <50 on the Aleutian and Pribilof Islands, Alaska (Mitchell 1998), 7,500-8,000 in Kamchatka, Russia (Gerasimov & Gerasimov 1990), 15,000 (Lu 1995) or 10,000-15,000 (Zheng & Wang 1998) in China, 500 in D.P.R. Korea (Pak 1995), 3,500 in the Republic of Korea (Park, J-Y. *pers. comm.* 1999), and 30,000 in Japan (average of 1992/93 - 1996/97 winters, WPD-EAJ 1997). Based on the information available, a revised total population of 60,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Russia						
Kharchinskoe Lake NR	N5632E16011	Summering	2000	-	11	Gerasimov 1995
Moroshechnaya River NR	N5630E15610	Summering	2000	-	11	Gerasimov 1995
Schmidt Peninsula	N5400E14230	Autumn	2700	1982autumn	11	Eryomin & Voronov 1984
Lake Bolon	N4948E13630	Spring	5000	1970s	11	Bocharnikov & Shibaev 1996
Mongolia						
Sangiyn Dalay Nuur	N4915E09900	Summering	270	1995spring	11	Braunlich 1995
Korea, D.P.R.						
Reservoirs in Yongsan-ri		Wintering	450	1994/95winter	11	Pak 1995
Korea, Republic of						
Ch'olwon Basin	N3815E12913	Wintering	400	1989/90winter	11	AWC
Cheon Su Bay	N3631E12625	Wintering	482	1994/95winter	11	Won 1995
Kum gang Estuary	N3552E12640	Wintering	1212	1994-1996	11	Kim *et al.* 1996
Sannam, Junam & Tongpan Reservior	N3518E12841	Wintering	817	1992-1996	8	Kim *et al.* 1996
Nakdong gang Estuary	N3508E12854	Wintering	1655	1992-1996	1	Kim *et al.* 1996
Japan						
Lake Notoro-ko	N4405E14405	Staging	400	1990-94	11	Abe *et al.* 1995
Notsuke Bay	N4335E14518	Staging	3155	1985-92	11	Abe *et al.* 1995
Lake Fukurojinuma	N4330E14145	Staging	650	1990-94	11	Abe *et al.* 1995
Lake Miyajimanuma	N4320E14143	Staging	410	1990-94	11	Abe *et al.* 1995

Lake Furen-ko	N4315E14514	Staging	10331	1986-92	11	Abe *et al*. 1995
Lake Akkeshi-ko	N4302E14442	Wintering	6050	1996/97winter	5	Albertsen & Mukai *unpubl*.
Kushiro Marsh	N4259E14424	Wintering	1500	1990-94	11	Abe *et al*. 1995
Mutsu Bay	N4103E14119	Wintering	1132	1996/97winter	11	EAJcount
Lake Ogawara-ko	N4047E14120	Wintering	683	1990-94	11	Abe *et al*. 1995
Mawarizeki Reservoir	N4045E14020	Wintering	500	1990-94	11	Abe *et al*. 1995
Hachirogata Rice Fields	N4000E14000	Wintering	4015	1990-94	11	Abe *et al*. 1995
River Tamagawa	N3935E14034	Wintering	979	1996/97winter	11	EAJcount
Shin-tsutsumi Reservoir	N3916E14105	Wintering	767	1996/97winter	11	EAJcount
River Omono-gawa	N3913E14029	Wintering	573	1996/97winter	11	EAJcount
River Mogami-gawa	N3853E13952	Wintering	3820	1996/97winter	11	EAJcount
Lakes Izunuma & Uchinuma	N3843E14107	Wintering	976	1990-94	11	Abe *et al*. 1995
Lake Naganuma	N3841E14108	Wintering	887	1996/97winter	11	EAJcount
China						
Sanjiang Nature Reserve	N4757E13423	Staging	400	1993spring	11	Zhang 1998
Xingkai Hu	N4515E13230	Staging	937	1995spring	11	Li *et al*. 1998
Bayinbuluke NR	N4250E08400	Summer	3130	-	11	Cai & Ma 1997
Qinghai Hu	N3650E10010	Wintering	1041	1990/91winter	11	AWC

Bewick's Swan (Tundra Swan)
Cygnus columbianus

Classification

Polytypic. Three subspecies have been described: the nominate form (Whistling Swan) in North America, *C. c. bewickii* in Western Eurasia and *C. c. jankowski* in eastern Asia. The validity of *jankowski* has been questioned because of the lack of any clear division between this and *bewickii*.

Distribution

Holarctic, breeds in Alaska, northern Canada and Arctic Russia and winters south to the USA, northwest Europe, the Caspian Sea and Eastern Asia. Only the subspecies *jankowski* occurs in Eastern Eurasia. This breeds in Arctic Russia east of the Lena delta, and winters in China, Korea and Japan.

Movements

Migratory; breeding in arctic latitudes and wintering in temperate latitudes. Several banded birds wintering in Japan has been recovered in the Chaunskaya Tundra (BMRCYIO 1985, Kistchinski 1979).

Population limits

Only one population is recognised in Eastern Eurasia.

Population size

- **Central Siberia / Eastern Asia: 40,000. 1% level 400.**
  Rose & Scott (1997) estimated 30,000 following Perennou *et al*. (1994). The most up-to-date population estimates or counts in the wintering range are: 10,000 in China (Lu 1995, Zheng & Wang 1998), 20 in D.P.R. Korea (Pak 1995), and 26,000 in Japan (average of 1992/93 - 1996/97 winters, WPD-EAJ 1997). In the Republic of Korea, wintering population level in an average year is between 500-1,000, with high of 1,300 in January 1992 and low of 156 in January 1999 (Park, J-Y. *pers. comm*. 1999). Based on the information available, a revised total population of 40,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Russia						
Kolyma Lowlands	N7000E15700	Summering	10000	1980-1990s	11	Mochalov 1997
Chaunskaya Tundra	N6900E16800	Summering	300	-	11	Andreev 1993
Korea, Republic of						
Upper Kum River Estuary	N3545E12632	Wintering	905	1993/94winter	11	AWC
Nakdong gang Estuary	N3508E12854	Wintering	1130	1992-1996	1	Kim *et al*. 1996
Japan						
Lake Kuccharo-ko	N4510E14220	Staging	20000	-	11	Hamatonbetsu Town
Lake Fukurojinuma	N4330E14145	Staging	1200	1990-94	11	Abe *et al*. 1995
Lake Miyajimanuma	N4320E14143	Staging	3216	1990-94	11	Abe *et al*. 1995
Lake Utonai-to	N4242E14143	Wintering	839	1990-94	11	Abe *et al*. 1995
Lake Ogawara-ko	N4047E14120	Wintering	441	1990-94	11	Abe *et al*. 1995
Ezogatate Reservoir	N4045E14020	Wintering	500	1990-94	11	Abe *et al*. 1995
Mawarizeki Reservoir	N4045E14020	Wintering	2000	1990-94	11	Abe *et al*. 1995
Otomonuma Reservoir	N4010E14000	Wintering	3000	1990-94	11	Abe *et al*. 1995
Hachirogata Rice Fields	N4000E14000	Wintering	3568	1990-94	11	Abe *et al*. 1995
River Mogami-gawa	N3853E13952	Wintering	2100	1996/97winter	11	EAJcount
River Hasama-gawa, Wakayanagi Town	N3846E14108	Wintering	1227	1996/97winter	11	EAJcount
River Hasama-gawa,	N3834E14113	Wintering	425	1996/97winter	11	EAJcount

Toyosato Town						
Kitashinbo-ooike Reservoir	N3810E13926	Wintering	728	1996/97winter	11	EAJcount
River Shiroishi-gawa	N3803E14044	Wintering	466	1996/97winter	11	EAJcount
Lake Fukushimagata	N3755E13916	Wintering	1420	1996/97winter	11	EAJcount
Lake Toyanogata	N3753E13904	Wintering	1609	1996/97winter	11	EAJcount
Lake Hyoko	N3750E13914	Wintering	2660	1996/97winter	11	EAJcount
Lake Sakata	N3749E13853	Wintering	2585	1996/97winter	11	EAJcount
River Shinano-gawa	N3737E13857	Wintering	949	1996/97winter	11	EAJcount
River Abukuma-gawa	N3730E14026	Wintering	938	1996/97winter	11	EAJcount
Lake Inawashiro-ko	N3728E14005	Wintering	1501	1996/97winter	11	EAJcount
Kamishigeoka Reservoir	N3719E14059	Wintering	460	1996/97winter	11	EAJcount
River Natsui-gawa	N3705E14052	Wintering	587	1996/97winter	11	EAJcount
Ouchigata Rice Fields	N3655E13650	Wintering	823	1997/98winter	1	Sawada T. *pers. comm.*
Lake Nakaumi	N3527E13316	Wintering	1003	1996/97winter	11	EAJcount
Nougi Rice Fields	N3523E13314	Wintering	502	1996/97winter	11	EAJcount
China						
Qinghai Hu	N3650E10010	Wintering	403	1987/88winter	11	AWC
Chongming Island	N3130E12145	Wintering	1200	1989/90winter	10	AWC
Poyang Lake	N2854E11616	Wintering	2104	1991/92winter	1	AWC

Swan Goose
Anser cygnoides

Classification

Monotypic. Vulnerable (IUCN 1996, Green 1996).

Distribution

Confined to Eastern Asia, breeding in the southern part of eastern Siberia to Russian Far East, Mongolia and northeastern China, and wintering in eastern China and Korea. There is a breeding record of the species in Kamchatka in the 19th century (Taczanowski 1893, Lobkov 1986). Japan had lost a small but regular wintering flock by about 1950 (Brazil 1990).

Movements

Migratory, breeding around Lake Baikal to the Amur Basin and northern Sakhalin, south to Mongolia and northeastern China; wintering in eastern China, mainly in the Yangtze River Basin and coast of East China Sea, and with a small number in Korea. Number of birds staging in Korea in autumn and spring is larger than that in mid-winter.

Population limits

Only one population is recognised, viz. the entire population of the species.

Population size

- **Entire population: Eastern Asia: 30,000-50,000. 1% level 400.**
  Rose & Scott (1997) estimated 50,000 following Callaghan & Green (1993). Callaghan (*in prep*.) estimated 30,000-50,000 following Lu (1996a). Korea has 1,800 (Park, J-Y. *pers. comm*. 1999) - 2,000 (Pak 1995) individuals in the period of migration, but the total number in winter is <100 individuals (Park, J-Y. *pers. comm*. 1999). Based on the information available, a revised total population of 30,000-50,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Russia						
Ulbansky Lowland	N5336E13700	Breeding	-	-	11	Poyarkov, N.D. *pers.comm.*
North-west Sakhalin Lowlands	N5215E14200	Breeding	200	-	11	Bocharnikov & Shibaev 1996
Udyl lake	N5206E13945	Breeding	340	1979	11	Poyarkov 1984
Mongolia						
Uldze River Basin	N4912E11337	Breeding	2600	1990-1994	11	Shiirevdamba 1997
Ayrag Nuur	N4853E09325	Summering	510	1995summer	11	Braunlich 1995
Ogii Nuur (Ugiy Nuur)	N4746E10246	Summering	1000	1977summer	11	Kitson 1978
Korea, D.P.R.						
Chongch'on Gang Estuary	N3943E12524	Spring	2000	1995spring	11	Pak 1995
Korea, Republic of						
Han gang Estuary	N3744E12640	Wintering	553	1994/95winter	11	AWC
China						
Qing Dao	N3610E12010	Wintering	600	1991/92winter	11	AWC
Pangzhai	N3520E11420	Wintering	412	1991/92winter	11	AWC
Heigangkuo (Yellow River Delta)	N3408E11404	Wintering	1500	-	11	Wang *et al.* 1994
Jiangsu Coast	N3400E12030	Wintering	9100	1990/91winter	11	AWC
Sheyang Salt Works	N3341E12032	Wintering	505	1989/90winter	11	AWC
Yancheng Shore	N3330E12015	Wintering	12441	1989/90winter	10	AWC
Yancheng Nature	N3329E12040	Wintering	1456	1995/96winter	1	AWC

Reserve						
Dongtai Dunmengkou	N3300E12050	Wintering	1144	1991/92winter	11	AWC
Dongtai Liulishe	N3240E12050	Wintering	1198	1991/92winter	11	AWC
Gaoyou And Shabo Lakes	N3235E11920	Wintering	1100	1989/90winter	11	AWC
Shijiuhu	N3123E11847	Wintering	1350	1988/89winter	11	AWC
Shengjin Hu	N3021E11705	Wintering	1170	1993/94winter	11	AWC
Daxi + Xiaoxi + Chai Shang Lakes	N2927E11250	Wintering	5600	1995/96winter	11	AWC
East Dongting Hu Nature Reserve	N2911E11225	Wintering	5600	1995/96winter	1	Lei & Qian 1998
Poyang Lake	N2854E11616	Wintering	6617	1991/92winter	1	AWC

Bean Goose
Anser fabalis

Classification

Polytypic. Five subspecies have been described: *A. f. fabalis* of northern Europe; *A. f. rossicus* of northern Russia east to northwest Siberia; *A. f. johanseni* of north-central Asia; *A. f. middendorfi* of eastern Asia; and *A. f. serrirostris* of northeastern Asia. The validity of the central Asian *johanseni* has been questioned (*e.g*. by Burgers *et al*. 1991). Both of *middendorfi* and *serrirostris* are listed in the threatened taxa: Vulnerable (Green 1996).

Distribution

Palearctic, breeding widely across northern Eurasia and wintering south to southern Europe, the Central Asian Republics, China and Japan. Two subspecies occur in Eastern Asia. *A. f. middendorfi* breeds in the taiga zone from eastern Siberia to Russian Far East, and winters in China, Korea and Japan. *A. f. serrirostris* breed in the tundra zone of northern Siberia east of Taimyr Peninsula to northern Far East and Kamchatka, and winters in China, Korea, and Japan. *A. f. johanseni* breeds in the taiga and forested tundra zones of north-central Asia from the Urals to Lake Baikal, and winters from Turkmenistan to western China. (*A. f. fabalis* and *A. f. rossicus* breed in the taiga and tundra zones, respectively, of northern Europe and winter south to southern Europe).

Movements

Migratory, wintering mostly at temperate latitudes. Some marked individuals of *A.f. serrirostris* nesting in northwestern Kamchatka, Russia, have been recovered in China, and those in southwestern part have been resighted in Japan. Movements of individuals of both subspecies moulting in southwestern Kamchatka have been resighted in Japan with some marked *A.f. serrirostris* have been resighted in Korea. Some marked *A.f. serrirostris* moulting in the Kolyma Lowlands have been resighted in Korea. But there has been no recoveries in Korea or Japan of marked *A.f. serrirostris* breeding in the Anadyr Lowlands.

Population limits

Two populations are recognised in Eastern Asia, corresponding to the two forms. Up to 90% of individuals in the wintering flocks in Japan are being separated to these two forms (Kurechi *et al*. 1983). The distribution range of the two forms largely overlaps outside the nesting area, but due to ecological differences between the forms, different sites are used in many areas in their migration and wintering period. It is useful to

separate the two forms into populations from a population management and conservation point of view.

Population size

- ***Anser fabalis middendorfi*: Eastern Taiga (breeding): 50,000-70,000. 1% level 600.**
  Rose & Scott (1997) estimated 10,000-100,000 using coded ranges. Callaghan (*in prep*.) estimated 50,000-70,000 based on Miyabayashi (1994), J.Y. Park (verbally 1995), Lu (1995) and Pak (1995). The most up-to-date population estimates or counts in the wintering range are: 50,000 in China (Lu 1995, 1999); 700 in D.P.R. Korea (Pak 1995); 6,000 in the Republic of Korea (1991/92 - 1998/99 winters, FRIK data: Park, J-Y. *pers. comm*. 1999); and 6,000 in Japan (average of 1995/96 - 1997/98 winters, JAWGP unpublished data). Based on the information available, a revised total population of 50,000-70,000 is proposed.
- ***Anser fabalis serrirostris*: Eastern Tundra (breeding): 45,000-65,000. 1% level 550.**
  Rose & Scott (1997) estimated 10,000-100,000 using coded ranges. Callaghan (*in prep*.) estimated 45,000-65,000 based on Miyabayashi (1994), J.Y. Park (verbally 1995), Lu (in litt. 1992) and Pak (1995). The most up-to-date population estimates or counts in the wintering range are: 20,000 in China (Lu 1995, 1999); 30,000 in the Republic of Korea (Park, J-Y. *pers. comm*. 1999); and 6,000 in Japan (average of 1995/96 - 1997/98 winters, JAWGP unpublished data). Based on the information available, a revised total population of 45,000-65,000 is proposed.

Table of key sites (Populations: ta = Eastern Taiga population; tu = Eastern Tundra population)

Site	Coordinates	Season	Pop	Population/ Count	Period/Date	Importance code	Ref
Russia							
Kolyma Lowlands	N7000E15700	Summering	tu	2500	1991summer	11	Andreev 1993
Chaunskaya Tundra	N6930E17000	Summering	tu	-	-	11	Andreev 1993
Middle Kolyma Valley - Evseiskie Ostrova	N6900E15830	Staging	tu	-	-	11	Andreev 1993
Middle Omolon valley	N6700E15930	Breeding	ta	-	-	11	Andreev 1993
Utkholok NR	N5730E15700	Summering	tu	5000	-	11	Gerasimov 1995
Kharchinskoe Lake NR	N5632E16011	Staging	?	4000	1975-1990	11	Gerasimov & Gerasimov

							1997a
Moroshechnaya River NR	N5630E15610	Moulting	ta	6000	early 1990s	11	Gerasimov & Gerasimov 1995b
South-West Tundra NR	N5158E15637	Summering	ta	1000	-	11	Gerasimov 1995
South-West Tundra NR	N5158E15637	Summering	tu	1000	-	11	Gerasimov 1995
Zeya - Bureya Lowland	N5030E12830	Spring	?	18000	1991-1994	11	Dugintsov 1996
Lake Bolon	N4948E13630	Spring	?	3000	1970s	11	Bocharnikov & Shibaev 1996
Korea, D.P.R.							
Chongch'on Gang Estuary	N3943E12524		?	500	1995spring	11	Pak 1995
Korea, Republic of							
Ch'olwon Basin	N3815E12713	Wintering	tu	13000	1993-1996	10	Kim *et al.* 1996
Upper Kum gang Estuary	N3808E12657	Wintering	?	3000	-	11	Won 1995
Taesong'dong & Panmunch'om Marshes	N3757E12642	Wintering	?	2650	1992/93winter	5	Won 1995
Han gang Estuary	N3744E12641	Wintering	tu	5857	1995-1996	5	Kim *et al.* 1996
Kanghwa Do Island	N3734E12626	Wintering	?	800	1992-1993	11	Kim *et al.* 1996
Asan Bay	N3656E12648	Wintering	tu	1850	1993-1996	10	Kim *et al.* 1996
Daeho Rsv.	N3650E12625	Wintering	tu	1369	1994-1996	11	Kim *et al.* 1996
Cheon Su Bay	N3631E12625	Wintering	tu	9500	1993-1996	5	Kim *et al.* 1996
Kum gang Estuary	N3552E12640	Wintering	?	2147	1994-1996	5	Kim *et al.* 1996
Wupo Reservoir	N3533E12825	Wintering	tu	1248	1993/94winter	5	Kim *et al.* 1996

Sannam, Junam & Tongpan Reservoir	N3518E12841	Wintering	ta	5959	1992-1996	1	Kim *et al*. 1996
Nakdong gang Estuary	N3508E12854	Wintering	ta	1723	1992-1996	1	Kim *et al*. 1996
Japan							
Sarobetsu Marsh	N4505E14141	Staging	ta	1500	-	11	Miyabayashi 1994
Lake Notoro-ko	N4405E14405	Staging	tu	1000	-	11	Miyabayashi 1994
Lake Tofutsu-ko	N4356E14425	Staging	tu	1200	-	11	Miyabayashi 1994
Lake Fukurojinuma	N4330E14145	Staging	ta	2500	-	11	Miyabayashi 1994
Lake Miyajimanuma	N4320E14143	Staging	ta	600	-	11	Miyabayashi 1994
Lake Furen-ko	N4315E14514	Staging	tu	1800	-	11	Miyabayashi 1994
Kushiro Marsh	N4259E14424	Staging	ta	500	-	11	Miyabayashi 1994
Kushiro Marsh	N4259E14424	Staging	tu	950	-	11	Miyabayashi 1994
Lake Ikusotanuma	N4250E14330	Staging	ta	722	-	11	Miyabayashi 1994
Lower Tokachi River	N4245E14337	Staging	ta	2000	-	11	Miyabayashi 1994
Atsuma Rice Fields	N4245E14150	Staging	tu	2000	-	11	Miyabayashi 1994
Lake Utonai-to	N4242E14143	Staging	?	2000	-	11	Miyabayashi 1994
Mawarizeki Reservoir	N4045E14020	Staging	ta	580	-	11	Miyabayashi 1994
Ezogatate Reservoir	N4045E14020	Staging	ta	1400	-	11	Miyabayashi 1994
Otomonuma Reservoir	N4010E14000	Staging	ta	2600	-	11	Miyabayashi 1994
Otomonuma Reservoir	N4010E14000	Staging	tu	1000	-	11	Miyabayashi 1994
Hachirogata Rice Fields	N4000E14000	Staging	ta+ tu	6500	-	11	Miyabayashi 1994
Hanamaki Rice	N3920E14105	Staging	tu	1330	-	11	Miyabayashi

Fields							1994
Hanayama-ko Reservoir	N3847E14052	Wintering	ta	899	1997/98winter	11	JAWGP *unpubl.*
Lakes Izunuma & Uchinuma	N3843E14107	Wintering	tu	2758	1997/98winter	11	JAWGP *unpubl.*
Lake Naganuma	N3841E14108	Wintering	ta	800	1997/98winter	11	JAWGP *unpubl.*
Lake Kabukurinuma	N3840E14110	Wintering	ta	993	1997/98winter	11	JAWGP *unpubl.*
Kejonuma Reservoir	N3838E14058	Wintering	tu	6425	1997/98winter	11	JAWGP *unpubl.*
Lake Fukushimagata	N3754E13915	Wintering	ta	3300	-	11	Miyabayashi 1994
Lake Toyanogata	N3754E13915	Wintering	ta	2000	-	11	Miyabayashi 1994
Lake Sakata	N3749E13853	Wintering	ta	2000	-	11	Miyabayashi 1994
Lake Asahiike	N3715E13820	Wintering	ta	1500	-	11	Miyabayashi 1994
Lake Biwa-ko	N3515E13605	Wintering	ta	600	-	11	Miyabayashi 1994
China							
Xingkai Hu	N4515E13230	Staging	?	3000	1988spring	11	Li *et al.* 1994
Beidaihe Coast	N3949E11930	Wintering	?	2605	-	11	Scott 1989
Huayan Rese.	N3910E11320	Wintering	?	800	1991/92winter	11	AWC
Qing Dao	N3610E12010	Wintering	?	500	1990/91winter	11	AWC
Heigangkuo (Yellow River Delta)	N3408E11404	Wintering	?	1460	1993/94winter	5	AWC
Jiangsu Coast	N3400E12030	Wintering	?	16500	1990/91winter	11	AWC
Sheyang Salt Works	N3341E12032	Wintering	?	3536	1989/90winter	11	AWC
Yancheng Nature Reserve	N3329E12040	Wintering	?	1858	1995/96winter	1	AWC
Gaoyou And Shabo Lakes	N3235E11920	Wintering	?	1300	1989/90winter	11	AWC
Shengjin Hu	N3021E11705	Wintering	?	580	1995/96winter	11	AWC
East Dongting Lakes	N2915E11255	Wintering	?	5693	1991/92winter	1	AWC

Poyang Lake	N2854E11616	Wintering	?	6800	1990/91winter	11	AWC
Wanzihu	N2850E11230	Wintering	?	507	1991/92winter	11	AWC

Greater White-fronted Goose
Anser albifrons

Classification

Polytypic. Five subspecies have bee described: the nominate form from northern Europe and Asia; *A. a. frontalis* from northeastern Siberia and northern Canada; *A. a. flavirostris* from Greenland; *A. a. gambelli* from the Mackenzie Basin region of Canada; and *A. a. elgasi* from the Anchorage region of Alaska. The validity of *elgasi* has been questioned.

Distribution

Holarctic, breeding at high latitudes in northern Europe, Asia and North America, and wintering south to Mexico, southern Europe, the Middle East, Eastern Asia. One subspecies occurs in Eastern Eurasia. *A.a. frontalis* breeds in the Arctic tundra from Lena delta east to Russian Far East, and winters in China, Korea and Japan.

Movements

Migratory, wintering at traditional sites mainly at temperate latitudes. Birds wintering in Japan are known to migrate northeast to the Koryak Coast through Kamchatka, Russia, whilebirds nesting in the Anadyr Lowlands migrate along the Amur River Valley to China, based on studies marking birds with satellite transmitters (Kurechi *et al*. 1995). One bird banded at Poyang Lake in China was recovered in the Kolyma Lowlands, Russia. Breeding birds on the Arctic Coast migrate south along the river valleys (Andreev 1997). Some birds in China or Korea are known to stop at Hokkaido Island, Japan, on their northward migration (Miyabayashi 1993). No Nearctic band has been recovered in Eastern Eurasia, nor Eurasian band in North America.

Population limits

Only one population is recognized in Eastern Eurasia.

Population size

- **Eastern Asia: 100,000-150,000. 1% level 1,250.**
  Rose & Scott (1997) estimated 50,000. The most up-to-date population estimates or counts in the wintering range are: 50,000 in China (Lu 1995, 1999); 3,600 in D.P.R. Korea (Pak 1995); and 50,000 in Japan (average of 1995/96 - 1997/98 winters, JAWGP unpublished data). In the Republic of Korea, the average wintering population between 1991/92 and 1998/99 winter was about 35,000, but the number reached more than 40,000 in the last few years (Park, J-Y. *pers.*

comm. 1999). Based on the information available, a revised total population of 100,000-150,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Russia						
Lena River Delta	N7300E12500	Breeding	14000	mid 1980s	11	Labutin & Degtyarev 1985
Yana-Indigirka Tundra	N7130E14000	Summering	44500	mid 1980s	11	Degtyarev 1990
Indigirka & Alazeya Lowlands	N7000E14830	Summering	16000	mid 1980s	11	Degtyarev 1990
Cape Billings	N6900E17600	Summering	-	-	11	Kondratyev 1988
Chaunskaya Tundra	N6900E16800	Summering	-	-	11	Andreev 1993
Middle Kolyma Valley - Evseiskie Ostrova	N6900E15830	Staging	-	-	11	Andreev 1993
Vankaremskaya Lowlands	N6800W17700	Breeding	-	-	11	Andreev 1993
Kolyuchin Bay Tundra	N6630W17700	Moulting	1200	1992summer	11	Andreev 1997
Kresta Bay	N6530W17800	Summering	-	-	11	Andreev 1993
Anadyr Lowlands	N6500E17830	Summering	3400	early 1990s	11	Kondratyev 1992
Khatyrka Valley	N6200E17500	Breeding	1650	1997summer	11	Kondratyev *unpubl*.
Malamvayam Lagoon (Geese Lagoon NR)	N5745E16227	Autumn	10000	1980s	11	Gerasimov & Gerasimov 1995b
Lake Kharchinskoe	N5632E16011	Spring	10000	1983spring	11	Gerasimov & Gerasimov 1995a

Kharchinskoe Lake NR	N5632E16011	Staging	9200	1975-1990	11	Gerasimov & Gerasimov 1997a
Zhupanova Lagoon NR	N5335E15950	Autumn	10000	1990s	11	Gerasimov & Gerasimov 1995b
Zeya - Bureya Lowland	N5030E12830	Spring	65000	1991-1994	11	Dugintsov 1996
Lake Bolon	N4948E13630	Spring	100000	1970s	11	Bocharnikov & Shibaev 1996
Korea, D.P.R.						
Chongch'on Gang Estuary	N3943E12524		2000	1995spring	11	Pak 1995
Kumya Wetland Reserve	N3925E12720		1600	1995spring	11	Pak 1995
Korea, Republic of						
Ch'olwon Basin	N3815E12713	Wintering	7000	1993-1996	5	Kim *et al*. 1996
Taesong'dong & Panmunch'om Marshes	N3757E12642		1500	1992/93winter	11	Won 1995
Han gang Estuary	N3744E12641	Wintering	6030	1995-1996	11	Kim *et al*. 1996
Sapkyo Lake	N3653E12651	Wintering	1500	1991/92winter	11	AWC
Kum River	N3604E12649	Wintering	7470	1990/91winter	5	AWC
Kum gang Estuary	N3552E12640	Wintering	4550	1994-1996	11	Kim *et al*. 1996
Sannam, Junam & Tongpan Reservoir	N3518E12841	Wintering	2470	1992-1996	5	Kim *et al*. 1996
Nakdong gang Estuary	N3508E12855	Wintering	1469	1990/91winter	11	AWC
Japan						
Lake Fukurojinuma	N4330E14145	Staging	1900	-	11	Miyabayashi 1994
Lake Miyajimanuma	N4320E14143	Staging	35000	-	11	Miyabayashi 1994
Atsuma Rice	N4245E14150	Staging	2000	-	11	Miyabayashi

Fields						1994
Lake Utonai-to	N4242E14143	Staging	20000	-	11	Miyabayashi 1994
Lake Benten'numa	N4239E14146	Staging	5000	-	11	Miyabayashi 1994
Lake Oikamanainuma	N4230E14330	Staging	2000	-	11	Miyabayashi 1994
Otomonuma Reservoir	N4010E14000	Wintering	21000	-	11	Miyabayashi 1994
Hachirogata Rice Fields	N4000E14000	Wintering	19000	-	11	Miyabayashi 1994
Lakes Izunuma & Uchinuma	N3843E14107	Wintering	47506	1997/98winter	1	JAWGP *unpubl.*
Lake Naganuma	N3841E14108	Wintering	4000	1997/98winter	11	JAWGP *unpubl.*
Lake Kabukurinuma	N3840E14110	Wintering	32000	1997/98winter	5	JAWGP *unpubl.*
Kejonuma Reservoir	N3838E14058	Wintering	3924	1997/98winter	5	JAWGP *unpubl.*
Lake Katano Kamoike	N3619E13618	Wintering	2200	1998/99winter	11	JAWGP *unpubl.*
Kuzuryu River	N3610E13610	Wintering	1500	-	11	Miyabayashi 1994
Lake Shinji-ko	N3526E13252	Wintering	1262	1997/98winter	11	Wakisaka 1998
China						
Shengjin Hu	N3021E11705	Wintering	2100	1995/96winter	11	AWC
Daxi + Xiaoxi + Chai Shang Lakes	N2927E11250	Wintering	2600	1995/96winter	11	AWC
Dongting Hu	N2911E11225	Wintering	7720	1996/97winter	11	Iwabuchi *et al*. 1997
Poyang Hu	N2854E11616	Wintering	61099	1988/89winter	5	AWC

Lesser White-fronted Goose
Anser erythropus

Classification

Monotypic. Vulnerable (IUCN 1996, Green 1996).

Distribution

Palearctic, breeding across northern Eurasia from northern Scandinavia to Russian Far East, and wintering south to southeastern Europe, the Middle East and Eastern Asia. In Eastern Eurasia, the species breeds from western Siberia eastwards; it winters mainly in eastern China. Until the 19th century, the species used to be a regular winter visitor to Japan.

Movements

Migratory, wintering at temperate latitudes. The migration of the species is poorly known in Eastern Eurasia. Data on staging sites is limited to counts of 3,000-7,500 birds in the Amur Basin, up to 400 birds in Kamchatka in 1980s, and up to 15 birds in Hokkaido, Japan, in mid 1990s (Iwabuchi 1997).

Population limits

Only one population is recognised.

Population size

- **Eastern Asia: 14,000. 1% level 140.**
  Rose & Scott (1997) estimated 6,000 following Perennou *et al*. (1994). Iwabuchi *et al*. (1997) counted 13,700 birds in the East Dongting Lakes in February 1997. Based on the information available, a revised total population of 14,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Russia						
Chaunskaya Tundra	N6930E17000	Staging	-	-	11	Andreev 1993
Middle	N6700E15930	Breeding	-	-	11	Andreev

Omolon valley						1993
Kharchinskoe Lake NR	N5632E16011	Staging	400	1975-1990	11	Gerasimov & Gerasimov 1997a
Zeya - Bureya Lowland	N5030E12830	Spring	3000	1991-1994	11	Dugintsov 1996
Lake Bolon	N4948E13630	Spring	5000	1970s	11	Bocharnikov & Shibaev 1996
China						
Xingkai Hu	N4515E13230	Staging	7500	1988spring	11	Li *et al*. 1994
Qing Dao	N3610E12010	Wintering	1200	1991/92winter	11	AWC
Heigangkuo (Yellow River Delta)	N3408E11404	Wintering	180	1993/94winter	5	AWC
Shijiu Hu	N3123E11847	Wintering	1150	1992/93winter	5	AWC
Hannan Lake in Wuhan Lakes	N3020E11350	Wintering	360	1989/90winter	11	AWC
East Dongting Lakes	N2911E11225	Wintering	13700	1996/97winter	5	Iwabuchi *et al*. 1997
Poyang Lake	N2854E11616	Wintering	9790	1988/89winter	11	AWC

Greylag Goose
Anser anser

Classification

Polytypic. Two subspecies have been described: the nominate form from western and northwestern Europe and *A. a. rubrirostris* from southeastern Europe and Asia.

Distribution

Palearctic, breeding widely at boreal and temperate latitudes across Europe and Asia, and wintering south to North Africa, the Middle East, and Southern and Eastern Asia. The subspecies *rubrirostris* only occurs in Eastern Eurasia, breeding in Central Asia, southern Russia, Mongolia, northern China, and wintering in India to southern China and northern Vietnam.

Movements

Mostly migratory, with a few populations sedentary in Western Eurasia. In Eastern Eurasia, the species breeds in boreal and temperate latitudes and move to winter at lower latitudes.

Population limits

Two wintering groups are recognised (Perennou *et al*. 1994): (1) Southern Asia and (2) Eastern Asia.

Population size

- **Southern Asia: 15,000 (Perennou *et al*. 1994). 1% level 150.**
  Rose & Scott (1997) estimated 15,000, following Perennou *et al*. (1994).
- **Eastern Asia: 50,000-100,000. 1% level 750.**
  Rose & Scott (1997) estimated 25,000-100,000, following Perennou *et al*. (1994). Lu (1995) estimates population in China as 50,000. There is no reliable estimate of the population wintering in Vietnam. Based on the information available, a revised total population of 50,000-100,000 is proposed.

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
China						
Xingkai Hu	N4515E13230	Staging	1000	1988spring	11	Li *et al.* 1994
Sheyang Salt Works	N3341E12032	Wintering	1300	1994/95winter	10	AWC
Yancheng Nature Reserve	N3329E12040	Wintering	2892	1995/96winter	1	AWC
Gaoyou And Shabo Lakes	N3235E11920	Wintering	880	1989/90winter	11	AWC
East Dongting Lakes	N2915E11255	Wintering	6300	1990/91winter	6	AWC
Poyang Hu	N2854E11616	Wintering	1089	1991/92winter	10	AWC

Bar-headed Goose
Anser indicus

Classification

Monotypic.

Distribution

Restricted to Central and Southern Asia. Discontinuous breeding range, restricted to selected high altitude wetlands in Central Asia, from extreme Eastern Kazakstan and Kyrgyzstan across southern Russia to western Mongolia, south through the Tibetan (Xizang) Plateau to Ladakh in northern India. Birds winter from Pakistan, India, Nepal, Bangladesh and Myanmar.

Movements

Not clearly understood. Largely migratory, with northern breeding birds migrating to Southern Asia. However, a significant proportion of the population also winter in China, in the Tibetan Plateau during mid October to April (Bishop *et al*. 1997), and in Yunnan and Guizhou in southern China (Lu 1991).

Based on movements of five marked birds on the breeding grounds, it is evident that birds from the northern breeding populations in Central Asia (south to Qinghai Lake in China) migrate to winter in Southern Asia. Two individuals banded in eastern Kyrgyzstan were recovered in Pakistan (Roberts 1991). Three birds banded at Qinghai Lake in China, were recovered on their wintering grounds: one in Karnataka state, southwestern India (Uttangi 1987), one in northeastern India and one around Chittagong, southern Bangladesh (National Bird Banding Center, P.R. China 1987).

Population limits

Based on the migration of a large proportion of birds to Southern Asia east to Myanmar, with a possibly largely sedentary population in western China, two populations are now recognised: (1) Southern Asia / Myanmar (wintering) and (2) China (wintering). Through an apparent oversight, Rose & Scott (1997) included only one population in Tibet/China/Myanmar (estimated at 11,000), excluding the larger population wintering in South Asia.

Population size

- **Southern Asia / Myanmar (wintering): 16,800-18,900. 1% level 180.**
- **China (wintering): 15,500-17,500 (Bishop *et al*. 1997). 1% level 160.**

Collating data on the population size of the species has been difficult, largely due to the restricted range and inhospitable habitats of the species and the lack of regular communication between researchers in the region (Gole 1998). Consequently, estimates of the population size have changed over the last decade as new information becomes available. A series of surveys have been undertaken in the breeding areas in the Qinghai-Tibet Plateau (including Hulun Nuur, in Inner Mongolia where the birds previously bred) and wintering areas in the Xizang (Tibetan) Plateau, Yunnan and Guizhou between 1988-1996. It is currently estimated that the wintering population of the species in China is 15,500-17,500 (Bishop *et al*. 1997).

Breeding population. Based on the information available, a total population size is derived from an estimate of the breeding population, in which the number of individuals in the population (35,850 individuals) is calculated as three times the number of breeding pairs (11,950), using the formula proposed by Meininger *et al*. (1995). A conservative estimate of about 11,950 breeding pairs across the breeding range is generated from a country-wise breakdown of the estimated number of breeding pairs: China - 10,000 Lu Jianjian (1991 and 1997), Russia (Tuva-Altai Mountains) - 100 (van der Ven 1997), Mongolia - 1,500 (Shiirevdamba 1997), Kyrgyzstan - 50 (Prakash Gole, *pers. comm*. 1999), Tajikistan - 100 (van der Ven, J. *pers. comm*. 1999), Afghanistan - 50 (personal estimate based on information in Scott 1995), and India (Ladakh) - 150 (Mishra & Humbert-Droz 1998).

Wintering population. A compilation of available data based on the AWC census and other current information suggests a total population of about 32,300-36,400 individuals.

- A conservative estimate of 15,000-17,000 individuals wintering in India (based on a suggested estimate by Prakash Gole (1997, *pers. comm*. 1999) that the wintering population is about 15,000 and a maximum of 17,834 individuals counted in 1992 during the AWC (Perennou & Mundkur 1992).
- A conservative estimate of 1,800-1,900 individuals in the rest of Southern / Southeastern Asia (Pakistan, Nepal, Bangladesh and Myanmar).
- An estimate of 15,500-17,500 individuals in China (Bishop *et al*. 1997).

Table of key sites

Site	Coordinates	Season	Population/ Count	Period/Date	Importance code	Ref
Mongolia						
Sangiyn Dalay Nuur	N4915E09900	Summering	170	1977summer	11	Kitson 1978
Holboo Nuur	N4908E09708	Summering	560	1977summer	11	Kitson 1978

Dzuun Nuur	N4903E09930	Summering	210	1977summer	11	Kitson 1978
Ayrag Nuur	N4853E09325	Summering	510	1995summer	11	Braunlich 1995
Terhiyn Tsagaan Nuur	N4810E09943	Summering	2100	1977summer	11	Kitson 1978
China						
Arketao	N3905E07550	Wintering	400	1990/91winter	11	AWC
Tuosu Hu	N3715E09710	Breeding	697	1987summer	11	Lu 1997
Qinghai Hu	N3650E10010	Summering	5520	1988summer	11	Lu 1997
Pangong Hu	N3450E09810	Breeding	127	1985summer	11	Lu 1997
Longbaotan NR	N3310E09635	Breeding	4000	1988summer	11	Scott 1989
Zalong Lake (Konglong bird island)	N3038E08612	Breeding	2000	1988summer	11	Piao & Liu 1994
Kazi Or Katzachinz Reservoir	N2953E09107	Wintering	931	1991/92winter	11	AWC
Lhasa He (Lhasa River)	N2938E09105	Wintering	3880	1991-1996	11	Bishop *et al*. 1997
Yarlung River Basin near Gonggar	N2930E09145	Wintering	660	1991-1993	11	Bishop *et al*. 1997
Kyichu R.: Doilendegen South To Qushui Br	N2930E09040	Wintering	125	1991/92winter	11	AWC
Yarlung River Basin near Shigatse	N2920E08935	Wintering	6512	1991-1993	11	Bishop *et al*. 1997
Nyang Chu (Oxbow)	N2911E08905	Wintering	1100	1991/92winter	11	AWC
Yarlung River Basin near Lhaze	N2910E08733	Wintering	1033	1991-1995	11	Bishop *et al*. 1997
Yangcaoyong Cuo (Yamdrok Tso)	N2900E09040	Wintering	267	1991-1993	10	Bishop *et al*. 1997

Napahai NR	N2752E09938	Wintering	145	1988/89winter	11	AWC
Caohai Nature Reserve	N2650E10415	Wintering	800	1995/96winter	2	Bishop *et al*. 1997
Daqiao Reservoir	N2641E10320	Wintering	800	1991/92winter	11	Wei *et al*. 1994
Huizi Daqiao	N2640E10310	Wintering	400	1991/92winter	11	AWC

Annex I
Asian Anatidae Atlas Project
Call for further information
March 1999

Conservation of birds largely depends on the conservation of natural habitats that the birds use through their annual cycle. Wetlands International with financial support from the Environment Agency of Japan has published an Atlas of Key Sites for Anatidae in the East Asian Flyway to assist in the identification of internationally important sites for Anatidae (ducks, geese and swans). The Atlas reviews the distribution of Anatidae species in the region, defines population boundaries and identifies important sites for these species. The Atlas is a valuable reference for government conservation agencies, technical experts, NGOs and local communities seeking to learn more about important sites and of the gaps in our knowledge. The project is part of an international collaborative effort to regularly compile published and unpublished information to promote conservation of sites. Data collated by the project is being stored in a central database that is being updated on an ongoing basis (the attached table provides information on the structure of the database).

The next stage of the project will be to produce an atlas of internationally important sites for Anatidae for the Asian region. In geographic coverage, it will extend across Russia from the Ural Mountains east to Far East, Eastern, Central, Southern, and Southeastern Asia and Alaska (USA). The Atlas will define population flyway boundaries and identify important sites in the Asian region for Anatidae, and provide a brief description on each species.

Two basic criteria, compatible with the Ramsar criteria for identification of wetlands of international importance are being used to identify sites:
(a) 20,000 individuals of total number of Anatidae supported; and
(b) 1% of a population of an Anatidae species.

In order to incorporate all available data, we seek the co-operation and participation of people who possess this information. Published and unpublished information is needed to identify key sites for each species throughout its range and we seek the following data:

- Name of the site;
- Co-ordinates (latitude, longitude) of the approximate geographic centre of the site;
- Protected status of the site: protected / partially protected / not protected / unknown;
- Population size / estimate of Anatidae that the site has supported: number, species, date/month/year, published or unpublished references.

To find out more about the project, kindly contact the project co-ordinators.

Project Co-ordinators:

Yoshihiko Miyabayashi
Anatidae Flyway Officer
of Wetlands International - Japan,
JAWGP, Minamimachi 16,
Wakayanagi, 989-5502 Japan
TEL&FAX +81-228-32-2592
E-mail: yym@mub.biglobe.ne.jp

Taej Mundkur
Wetlands International - Asia Pacific,
3A39, 4th Floor, Block A
Kelana Centre Point, No 3, Jalan SS7/19
47300 Petaling Jaya, Selangor, Malaysia
Tel: +60-3-704 6770
Fax: +60-3-707 6772
Email: taej@wiap.nasionet.net
URL: http://ngo.asiapac.net/wetlands/

Database structure of Asian Anatidae Data for Atlas Project

To collate information on the Anatidae in Asia, a customised database has been developed by Wetlands International. The database is broadly compatible to the Asian Waterfowl Census database developed and operated by Wetlands International and is being used to store information of the census. The Anatidae Atlas database structure has been developed to permit use in a variety of commercially available software and has been tested on dBASE IV™, Microsoft Access™, and Microsoft Excel™.

The accompanying table provides a structure of the database. Abbreviations listed under Field Type refer to C - Character, N - Numeric, L - Logical, D - Date data fields.

No.	FIELD NAME	FIELD TYPE	FIELD LEN	FIELD DEC	CONTENT
1	COUNTRY	C	16		Name of country
2	SITE	C	40		Name of site
3	LATITUDE	N	5	2	Degrees of latitude from the equator
4	LATSOUTH	L	1		Only select yes if site is south of the equator
5	LONGITUDE	N	6	2	Degrees of longitude
6	LONGWEST	L	1		Only select yes if site is in the Western Hemisphere
7	SITECODE	C	9		Sitecode for office purposes only (do not enter this field)
8	NUM	N	6		Number for site (if a national code exists)
9	IMPORTANCE	C	6		Criterion meeting data as: • "**20000**": >20,000 • "**1%**": >1% of a population

					• "**Anatid**": important for all types of Anatidae • "**goose**": important for only Goose • "**swans**": important for only Swans • "**ducks**": important for only Ducks • "**unfav**": important for species with least favourable conservation status
10	SEASON	C	20		**wintering** / **staging** / **autumn** / **spring** / **breeding** / **moulting**
11	NAME	C	50		Species / subspecies scientific name for data
12	SPECIES	C	5		5 character code for office purposes only (do not enter this field)
13	COUNT	N	8	0	Exact number of birds counted during a single count
14	DATE	D	8		Exact count date of the single count
15	POPULATION	N	8	0	Population size counted or estimated or averaged (based on more than one count)
16	DATAYEAR	N	4	0	Year of counts / estimates
17	DATAMONTH	C	3		Month of counts / estimates
18	PERIOD	C	15		Period of years if population size is estimated or averaged
19	AREA	N	5	0	Area of site in hectares
20	HABITAT	C	4		Principle habitat type(s), list up to 4 types: **0** Open sea, bay, strait; **1** Estuary; **2** Brackish or saline lake, lagoon, salt pans; **3** River, stream, canal; **4** Freshwater marsh, flooded area; **5** Freshwater lake, pond; **6** Reservoir, barrage, tank; **7** Gravel pit; **8** Aquaculture pond (fish or shrimp); **9** Grassland, arable land; **A** Mangrove, nipah; **B** Freshwater swamp forest; **C** Freshwater peat forest;

					D Rocky beach/shore; **E** Sandy beach/dune; **F** Mudflat (tidal/river); **G** Sewage farm/ponds; **H** Saltmarsh; **L** Delta; **U** Peatland; **V** Alpine/Tundra; **W** Shrub dominated; **X** Tree dominated; **Y** Oases (springs)
21	OWNERSHIP	C	2		Ownership Status: **1** fully protected, **2** partially protected, **3** not protected, **0** unknown
22	PROTECTION	C	2		Protection Status: **1** by government, **2** by tradition, **3** private ownership, **4** unprotected, **0** unknown
23	RAMSAR	L	1		Select yes only if site is a Ramsar site
24	REFNUM	N	6	0	Number for published reference of data
25	REFSHRT	C	40		Reference of data

Annex II
A Preliminary List of Key Sites that support at least 20,000 Anatidae in the East Asian Flyway

A wetland is identified as being of international importance if it regularly supports 20,000 waterfowl (Ramsar Criterion 3a). This criterion refers to all waterfowl as defined by the Convention, including Anatidae. A preliminary list of key sites that support 20,000 or more individuals of Anatidae, comprising of one or more species identified in the Project is presented here. The list includes sites identified on the basis of single or more counts and estimates of the number of single or more Anatidae species. These sites are presented in the accompanying table and map.

Information on key sites presented in the table is as follows:

- Site: The name is taken from the source of the data in most cases, while others follow A Directory of Asian Wetlands (Scott 1989). The name of a site may be confusing since there are different ways of naming a site in the English language. An asterisk mark indicates that the site is on the Ramsar List (as at 7 March 1999). A site with an asterisk mark in parenthesis indicates that the site contains within it, one or more area(s) on the Ramsar List.;
- Co-ordinates: the approximate geographic centre of the site in degrees and minutes;
- Protected: the conservation status of the site: fully protected / partially protected / not protected / no data available (blank);
- Season: the time of the year during which the site is important for birds: wintering / staging / breeding / moulting;
- Period: the period of data; and
- Ref: the source of data; where derived from the AWC database and the national count in Japan these are indicated as AWC / EAJcount, respectively.

A preliminary list of key sites that support at least 20,000 Anatidae in the East Asian Flyway.
An asterisk mark indicates that the site is on the Ramsar List (as at 7 March 1999). A site with an asterisk mark in parenthesis indicates that the site contains within it, one or more area(s) on the Ramsar List.

Site	Coordinates	Protected	Season	Period	Ref
USA					
Yukon-Kuskokwim Delta	N6100W16500	Fully	Breeding	1985-1998	Bowman *et al.* 1998

(*) Alaska Peninsula	N5600W16100	Partially	Staging	1981-1998	Petersen 1994,USFWS *unpubl.*
Russia					
Lena River Delta	N7300E12500	Partially	Moulting	1980-1993	Degtyarev 1995
Yana-Indigirka Tundra	N7130E14000	Partially	Summering	mid 1980s	Degtyarev 1990
Wrangel Island	N7130W17930	Fully	Nesting	1997summer	Baranyuk, V.V. *pers.comm.*
Yana River Delta	N7130E14000	Partially	Moulting	1980-1993	Degtyarev 1995
Indigirka & Alazeya Lowlands	N7000E14830	Partially	Moulting	1980-1993	Degtyarev 1995
Anadyr Lowlands	N6500E17830	Partially	Summering	early 1990s	Kondratyev 1992
Penzhina Valley	N6215E16640	Partially	Summering	early1980s	Gusakov 1988, Gerasimov & Gerasimov 1997b
* Karaginskiy Island NR	N5852E16353	Fully	Summering	-	Gerasimov 1995
Kharchinskoe Lake NR	N5632E16011	Fully	Staging	-	Gerasimov 1995
* Moroshechnaya River NR	N5630E15610	Fully	Summering	-	Gerasimov 1995
Shantar Islands	N5430E13730		Staging	1991-1992	Roslyakov & Roslyakov 1996
Zhupanova Lagoon NR	N5335E15950	Fully	Summering	-	Gerasimov 1995
Pil'tun Bay	N5310E14322		Summering	1990summer	Poyarkov & Rozanov 1998
Lunskiy Bay	N5128E14354		Autumn	-	Revyakina & Zykov 1996
* Zeya - Bureya Lowland	N5030E12830	Partially	Spring	1991-1994	Dugintsov 1996
* Lake Bolon	N4948E13630	Partially	Spring	1970s	Bocharnikov & Shibaev 1996
Aniva Bay	N4600E14200		Spring	1976-1992	Nechaev 1996

* Lake Khanka	N4453E13226	Partially	Spring	-	Bocharnikov & Shibaev 1996
Lower Tumangan River	N4229E13054	Partially	Spring	1961-1995	Litvinenko & Shibaev 1996
Korea, Republic of					
Han gang Estuary	N3744E12640	Partially	Wintering	1992/93winter	AWC
Sapkyo Lake	N3653E12651	Not	Wintering	1990-1996	AWC, Kim *et al*. 1996
Chonsu Lake	N3640E12625	Partially	Wintering	1992-1996	AWC, Kim *et al*. 1996
Nonsan Reservoir	N3620E12710		Wintering	1995/96winter	Kang & Cho 1996
Kum River	N3604E12649	Not	Wintering	1989-1996	AWC
Kum gang Estuary	N3552E12640	Not	Wintering	1994-1996	Kim *et al*. 1996, Kang & Cho 1996
Sannam, Junam & Tongpan Reservoirs	N3518E12841	Partially	Wintering	1987-1996	AWC, Kang & Cho 1996, Kim *et al*. 1996
Nakdong gang Estuary	N3508E12854	Partially	Wintering	1992/93winter	Won 1995
Japan					
* Lake Kuccharo-ko	N4510E14220	Fully	Staging	-	Hamatonbetsu Town *pers. comm.*
Lake Miyajimanuma	N4320E14143	Not	Staging	-	Miyabayashi 1994
* Lake Utonai-to	N4242E14143	Fully	Staging	-	Miyabayashi 1994
Mawarizeki Reservoir	N4045E14020	Fully	Wintering	1990-94	Abe *et al*. 1995
Otomonuma Reservoir	N4010E14000	Partially	Wintering	-	Miyabayashi 1994
River Mogami-gawa	N3853E13952	Partially	Wintering	1996/97winter	EAJcount
Lakes Ooyama Kamiike & Shimoike	N3845E13946	Fully	Wintering	1996/97winter	EAJcount
* Lakes	N3843E14107	Fully	Wintering	1990-1997	Abe *et al*. 1995,

Izunuma & Uchinuma					JAWGP *unpubl.*
Lake Kabukurinuma	N3840E14110	Not	Wintering	1996-1998	JAWGP *unpubl.*
Kahokugata Rice Fields	N3638E13640	Partially	Wintering	1996/97winter	EAJcount
Tokyo Bay, Inner Area	N3539E13955	Partially	Wintering	1990-1997	Abe *et al*. 1995, EAJcount
Lake Nakaumi	N3528E13311	Partially	Wintering	1990-1997	Abe *et al*. 1995, EAJcount, SB-WBSJ 1998
Lake Shinji-ko	N3526E13252	Partially	Wintering	1996/97winter	SB-WBSJ 1998
* Lake Biwa-ko	N3515E13605	Partially	Wintering	1989,94	Abe *et al*. 1995
Lake Hamana-ko	N3445E13735	Partially	Wintering	1997/98winter	Shizuoka Pref. *unpubl.*
Shiokawa Tidalflats	N3441E13717	Partially	Wintering	-	Scott 1989
China					
Sanjiang Provincial Nature Reserve	N4755E13422	Fully	Breeding/ Staging	1997-1998	Sanjiang NR *unpubl.*
Xingkai Hu	N4515E13230	Fully	Staging	1988spring	Li *et al*. 1994
Nansi Hu	N3453E11658	Fully	Wintering	-	Scott 1989
Linhonghe Kou (Lianyungang Coast)	N3430E11920	Fully	Wintering	1991/92winter	AWC
Jiangsu Coast	N3400E12030	Fully	Wintering	1990/91winter	AWC
Sheyang Salt Works	N3341E12032	Fully	Wintering	1991/92winter	AWC
Yancheng Shore	N3330E12015	Fully	Wintering	1989-1993	AWC
Hongze Hu	N3320E11830	Partially	Wintering	1989/90winter	AWC
* Dongting Hu	N2911E11225	Partially	Wintering	1991-1997	AWC, Lei, G. *et al*. *unpubl.*
* Poyang Lake	N2854E11616	Fully	Wintering	1987-1990	AWC
Caohai Nature Reserve	N2650E10415	Fully	Wintering	1992/93winter	AWC
* Mai Po and Deep Bay wetlands	N2232E11400	Fully	Wintering	1993-1997	Young L *pers.comm.*
Thailand					

Beung Boraphet	N1542E10015	Fully	Wintering	1990/91winter	AWC
Cha-Vak Lake	N1455E10004	Fully	Wintering	1993/94winter	AWC
Kasetsart University (Kampaengsaen)	N1350E10005		Wintering	1989/90winter	AWC
Vietnam					
Dong Thap Muoi in Mekong Delta	N1047E10540	Partially	Wintering	1987/88winter	Scott 1989
Tram Chin Nature Reserve	N0940E10540	Fully	Wintering	1992/93winter	AWC
Myanmar					
Inle Lake	N2010E09702	Not	Wintering	1989/90winter	AWC

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Authors
Yoshihiko Miyabayashi and Taej Mundkur

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402 Axes Nishishinjuku, 8-5-3 Nishishinjuku, Shinjuku-ku, Tokyo 160-0023, Japan
Tel: +81 3 5332 3362; Fax: +81 3 5332 3364;
E-mail: wijp@t3.rim.or.jp

And

Wetlands International - Asia Pacific
3A39, 4th Floor, Block A, Lobby C, Kelana Centre Point, No. 3, Jalan SS7/19
Kelana Jaya, 47301 Petaling Jaya, Selangor, Malaysia
Tel: +60 3 704 6770; Fax: +60 3 704 6772
E-mail: wiap@wiap.nasionet.net
Web site: http://ngo.asiapac.net/wetlands

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