Waterbird Population Sizes, Trend estimates and Population Boundaries for the 1st Conservation Status Review of Migratory Waterbirds in the EAAF Partnership Area- Methodological notes

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Introduction

The 1st Conservation Status Review of Migratory Waterbirds in the East Asian-Australasian Flyway (EAAF CSR 1) is being produced as per Decision 10.12[1] of the East Asian-Australasian Flyway Partnership (EAAFP). Population size, 1% thresholds and trend estimates of the EAAFP populations have until now used the latest global Waterbird Population Estimates (WPE), currently in the 5th edition (2012). The data from the EAAF CSR1 as well as other regional and global publications are accessible through the WPE Portal[2]. The general terms and standards applied in the WPE and CSR processes are described under the Data Presentation menu on the WPE Portal. This document complements those explanations with the special regional interpretations of terms and standards.

How to access the data?

Currently the portal shows data from the last published global dataset, i.e. WPE5 in 2012, as default. To show data for the **EAAF CSR1**, the user shall use the **Search menu** or **Start searching the database now!** link. Select EAAF CSR1 from the **Publication** dropdown box and tick EAAFP in the **Conservation framework column.** Alternatively, use the following link: http://wpe.wetlands.org/search?form%5Bspecies%5D=&form%5Bpopulation%5D=&form%5Bpublication%5D=12&form%5Bprotection%5D%5B3%5D=3.

Until the CSR1 is published, you need to register and login to the WPE portal before you can see the draft CSR1 assessments. At the time of writing, updates were made for about 100 populations in the CSR1. When no new information has been identified, entries are identical to the WPE5 entries.

The data for the selected publication is presented in an overview table format. Explanation of the meaning and conventions related to each column related to **Species & Populations**, **Population Estimates**, **Population Trends** and **1% threshold** are presented in the relevant sections of the **Data Presentation** menu.

On screen, the references as well as the size (start with S) and trend (start with T) notes can be read by moving the mouse pointer over the blue links.

Clicking on the blue population name opens the population details view with all the earlier WPE and CSR assessments for the population. On this screen references and notes appear at the bottom of the page but moving the mouse pointer over the link also works.

It is also possible to print or save as a PDF file the whole document by clicking on the **Print** link at the bottom of the page. In this case references and notes appear at the end of the document.

Treatment of sources

For many populations, size and trend estimates are produced based on the collective effort of organisations participating in the Asian Waterbird Census and other researchers who collect and analyse water- and seabird data. A wide range of sources were collected to estimate the size and trends of the 270 populations of water- and seabirds included in this report. This includes trend analyses reports, global or regional Red List assessments, specialised taxonomic or regional status assessments, action plans, information available from EAAFP Working Groups, Task Forces or IUCN SSC and Wetlands International Species Specialist Groups, articles or, occasionally, personal communications with researchers and specialists. Published population size and trend estimates were reviewed critically. If there were multiple references, the recency and the quality of the data were assessed, and the more recent and better assessments were used.

If only a single source of reference was used for the population size or trend estimate and the data is presented as in the reference, details are not repeated in the Notes fields. The user is expected to consult the reference for further details. In such cases, the standards of the WPE Portal or described in this document were followed only as far as possible. This means for example that trend periods may differ from our standard 10-year period.

[1] https://www.eaaflyway.net/decision-12-development-of-an-eaafp-conservation-status-review-pdf/
[2] http://wpe.wetlands.org/search

Taxonomy & Nomenclature

The taxonomy is harmonised with the nomenclature in the *HBW and BirdLife International Checklist of the Birds of the World*, as per EAAFP Decision 10.10[3]. This also serves as the official taxonomic reference to the IUCN Red List, the Convention on Migratory Species and AEWA, and is expected to be implemented globally in the 6th edition of the Waterbird Population Estimates.

1. Population Size Estimates

In the majority of cases, the population size is estimated based on estimates of non-breeding populations based on the January waterbird counts (AWC). Whether data from the breeding or from the non-breeding season is used depends on:

(1) When the population does not overlap with other populations,

(2) Quality and scope of the surveys in the given season,

(3) Whether the population size can be reliably deduced from auxiliary information during the overlap period.

Occasionally, results of migration counts at bottleneck or staging sites may also be used.

If the population does not overlap with other populations in any part of its annual cycle and all other factors are equal, the following seasons are considered to be more appropriate to estimate populations size:

(1) Non-breeding (northern mid-winter) or migration counts: for populations that are highly concentrated at non-breeding/wintering or stop-over sites and that breed at remote areas (e.g. Arctic) or are rather obscure during the breeding season;

(2) Breeding season surveys: colonial breeding and dispersed breeding birds at lower latitudes, especially if only a small proportion of the population can be counted during other seasons.

If the population size can be estimated in both seasons and estimates are available, we would be able to compare the quality and scope of the available estimates and choose the data from the most comprehensive source with the least bias. However, for most populations, reliable breeding season surveys across their range is not currently available.

In case of non-breeding or bottleneck counts, data from synchronised counts are preferred to totals of national estimates of seasonal maximums because the latter includes some double counting.

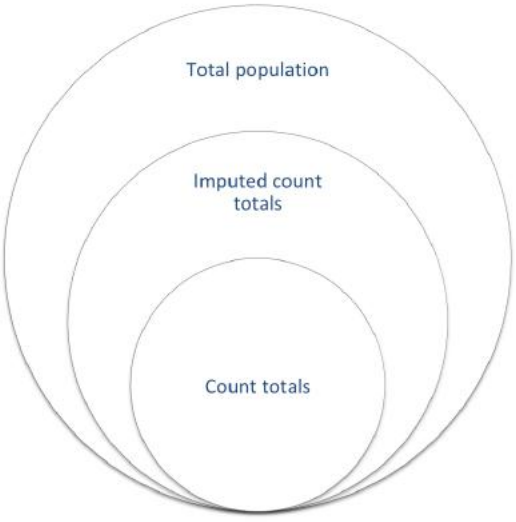

Figure 1. Relationship between count totals, imputed count totals and total population estimate.

[3] https://www.eaaflyway.net/decision-10-standardized-taxonomy-for-migratory-waterbirds-pdf/

Population estimates are not simple aggregations of count data. Apart from full censuses, counts include only a fraction of the population and thus represent an absolute minimum estimate of the population. Imputing and similar methods (Ter Braak et al. 1994) can account for missing counts from the site network included into the calculations and this may represent a good approximation of the total population if all or the vast majority of the population is included into the monitoring site network. However, this is rarely the case across the flyway and the proportion of the population not surveyed also need to be estimated even in countries with high coverage (Frost et al. 2019). As such estimates are rarely available for the entire population, and estimates based solely on count totals or count totals accounting for missing counts can be considered only as minimum population estimates.

Countries and regions contributing to the estimate are listed in the notes using their two-letter ISO codes.

Minimum & Maximum

The WPE Portal suggests that entering the same value as a minimum or maximum should be avoided where possible, unless the estimate quality is accurate down to the individual bird. Nevertheless, many references provide only a single figure. We apply the following guidelines:

(1) We use the minimum and maximum estimates if only these are available; (a) If count totals are higher than the minimum of the breeding estimate converted to total number of individuals, we use the count total as the minimum estimate;
(2) We use the lower and upper confidence limits of a population estimate based on a statistically robust estimate because this represents the accuracy of the estimate better than a single figure;
(3) We also use a single figure when time series data is available and

(a) The population is stable: in such case we use the five-year-mean;

(b) The population is monotonously increasing or decreasing: we use the number from the last year as a single figure;

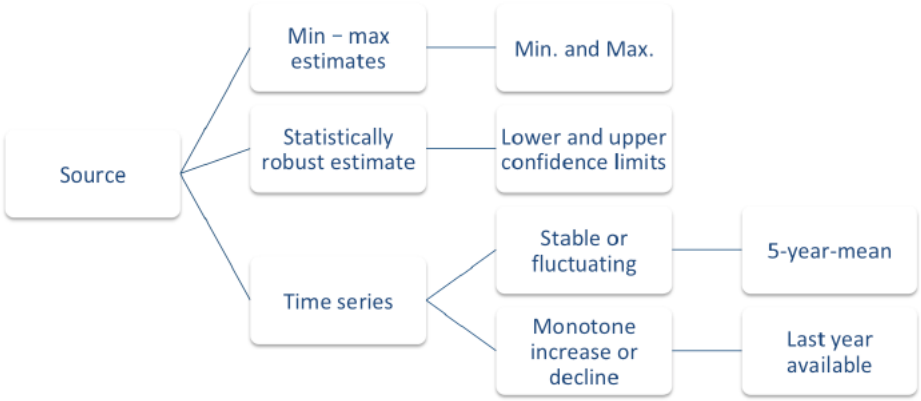

Figure 2. Decision tree showing the choice of population size estimate based on data availability and trend.

Estimate Quality

The WPE Portal uses a set of quality codes. These are defined under the **Estimate quality** section on the **Population Estimates** page of the WPE Portal. However, we use the *Best guess* category not only when the population estimate is only possible with large or uncertain ranges that are equivalent to the letter coded ranges (A: <10,000, B: 10,000 - 25,000, C: 25,000 - 100,000, D: 100,000 - 1,000,000, E 1,000,000) in earlier editions of the WPE, but also when the maximum is more than two times larger than the minimum.

The WPE population size estimate quality codes were established before other organisations have developed their codes. Therefore, the relationship between the WPE quality codes and other systems are presented in Table 1.

Table 1. Correspondence amongst various population size estimate quality codes. Links provided to the detailed definitions.

WPE Code	BirdLife International/IUCN	EU/AEWA method codes (see page 25)
No estimate: No population estimate is available;	Insufficient or no data available	
Best guess: Population estimate is only possible with large or uncertain ranges;	Poor	Based mainly on expert opinion, with very limited data
Expert opinion: Population estimate is based on incomplete survey and monitoring data and population size has been developed employing some expert opinion for extrapolating from this data with more accuracy than a best guess	Medium	Based mainly on extrapolation from a limited amount of data
Census based: Population estimate is based on almost complete census or statistically adequate sampling.	Good	Complete survey or a statistically robust estimate

2. Population Trends

The WPE Portal uses a set of trend codes:

DEC: Declining
INC: Increasing
STA: Stable
FLU: Fluctuating
EXT: Extinct
Unknown

For the CSR, population trends were assessed against three criteria:
• The 10-year trend is used to assess whether a population is in rapid short-term increase or decline.
• The population change over three generations is important in the context of application of BirdLife/ IUCN Red List assessment.
• The overall trend provides context to judge whether a population has changed in the last three generations.

We report a population **increasing** or **decreasing** if the population growth rate (multiplicative slope of the population trend) is significantly different from 1.00. The population is considered being **stable** if the population growth is within the range of 0.95 – 1.05 and not significantly different from 0.

However, robust monitoring data is often not available for waterbird populations across the region. Even if waterbird monitoring is adequate, year-to-year changes are often so large that the short-term trend becomes statistically not significant even if it was significant in the longer term and the growth rate of the two trends are identical. In such cases, we follow the methodology adopted by the African Eurasian Waterbird Agreement Conservation Status Review 8th edition (AEWA CSR8) and classify a short-term trend decreasing or increasing if the population change probably exceeds 10%.

If a source data is available at regional level, the trend information was used only if region approximately matches the population.

The trend assessment is based on the 10-year trend in most cases. If no trend data is available from the last 10 years, then the trend is recorded as **Unknown**.

In cases where the trend is less certain a "?" may be appended to the trend code, or 2 trend types separated by a "/" e.g. DEC/STA. However this has been avoided as much as possible.

- Trend directions are reported without a '?' mark if short-term trends from all sources are statistically certain and point into the same directions.
- Trend directions are reported with a '?' mark if the trend is statistically uncertain but there is a clear tendency in the data (i.e. the population is estimated to decrease or increase by more than 10% in the short-term).
- Two trend directions are reported with a '/' if different sources report different short-term trends and none of them is considered more reliable than the other.

The short-term trend is reported as **Uncertain**, if the data show no clear tendency and the confidence limits of slope estimate exceeded the ±5% range in either direction. If available, the 3-generation and the overall trend as well as other available evidence is mentioned in the notes.

The term **Fluctuating** as defined by the AEWA Technical Committee[4] provides useful clarification for waterbirds, "Large fluctuations can be said to occur where population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than a factor of two (i.e., doubling or halving) within a short period of time (typically three years or one generation, whichever is longer)." As of now, no CSR populations are identified as fluctuating.

[4] https://www.unep-aewa.org/sites/default/files/document/mop5_21_def_extr_fluct_aewa_table_0.pdf

The trend statistics over 3 generations are not calculated if the start year exceeds available data. Generation lengths are based on Bird et al. (2020).

Start & End Year

The start and end years are preferably based on the period of the short-term trend. This is usually defined as the last 10 years of the overall trend. Typically, the overall trend is calculated from 1987 until 2020, so the start and end year is often 2011-2020.

In other cases, the reported start and end year reflects the information provided in the reference. If the trend period is not stated explicitly in the reference, similar approximations were used as in case of defining start and end years for the population size estimates.

The trend was reported as **Unknown**, if the end year of the last available trend period is before 2011. This means that trend estimates in references dated before that date were not carried forward any longer as they do not necessarily represent the current trend of the population.

Trend Quality

The WPE Portal provides the standard trend quality codes. During the CSR1 process these codes were interpreted further as follows:

1. **No idea:** No monitoring at international scale in either breeding or non-breeding/wintering periods. Trends unknown. This category also includes populations where trends are statistically uncertain unless other evidence allows estimation of the trend.
2. **Poor:** Some international monitoring in either breeding or non-breeding periods although inadequate in quality or scope. Trends assumed through partial information.
    a. Assumed based anecdotal information or based on habitat change;
    b. Unrepresentative coverage;
    c. Short-term trend based on <5 years of data

3. **Reasonable:** International monitoring in either breeding or non-breeding/wintering periods that is adequate in quality or scope to track direction of population changes.
    a. Trend is statistically uncertain but has adequate quality and scope.
    b. Different sources provide different trend direction

4. **Good:** International monitoring in either breeding or non-breeding/wintering periods that is adequate in quality or scope to track direction of population changes with defined statistical precision. The trend is statistically certain and has adequate quality and scope.

The WPE population trend estimate quality codes were established before other organisations have developed their codes and it is based on the system of the International Wader Study Group. Therefore, the relationship between the WPE quality codes and other systems are presented in Table 2.

Table 2. Correspondence amongst various population trend quality codes. Links provided to the detailed definitions.

WPE	BirdLife International/IUCN	EU/AEWA method codes (see page 28)
1. No idea: No monitoring at international scale in either breeding or non-breeding/wintering periods. Trends unknown. This category also includes populations where trends are statistically uncertain unless other evidence allows estimation of the trend.	Insufficient or no data available	
2. Poor: Some international monitoring in either breeding or wintering periods although inadequate in quality or scope. Trends assumed through partial information.	Poor	Based mainly on expert opinion, with very limited data
3. Reasonable: International monitoring in either breeding or non-breeding/wintering periods that is adequate in quality or scope to track direction of population changes.	Medium	Based mainly on extrapolation from a limited amount of data
4. Good: International monitoring in either breeding or non-breeding/wintering periods that is adequate in quality or scope to track direction of population changes with defined statistical precision.	Good	Complete survey or a statistically robust estimate

Notes

Additional information and rationale on trends are included in the Note field, including:

- If a population is in long-term decline or;
- If evidence shows that it is no longer in significant long-term decline;
- If a population is in rapid short-term decline[5].

[5] See Langendoen et al (2021) for an explanation of long-term decline or rapid short-term decline.

3. Population Boundaries

Draft maps are available on http://wpp-review.wetlands.org/ Guidance on providing feedback is available on this site. Modified boundaries can be submitted to wpe@wetlands.org. All proposals for boundaries must be provided with references and supporting evidence.

For each species, a simple map (polygon) provides the geographic limits of each biogeographic population. Population boundaries follow the range definition of the Convention on Migratory Species (Article I.1.h): "*Range means all the areas of land or water that a migratory species inhabits, stays in temporarily, crosses or overflies at any time on its normal migration route*". As it is also stated in the flyway definition for populations, the range includes the breeding, moulting and non-breeding and all areas passed between these. This range definition is also applicable to sedentary or dispersive species and their populations.

The aim of the delineation of biogeographic populations is to assist conservation and management. Therefore, it is more important to capture the main distribution areas than including the exceptions. Thus the population boundaries should encompass the areas where the species normally occurs, and vagrants should not be included into the range of the population. Additionally, areas used during cold or dry weather movements should be included because using those areas is a critical part of the species ecology and survival strategy.

Given the current information available for waterbirds is very variable, it is rarely possible to define ideal populations. We foresee that with advances in technology and knowledge of the movements of birds, the quality and accuracy of the precise boundaries of these maps will be improved in future.

Preparation and review

This is the first time that we produce population boundary maps for most EAAF populations. Population boundaries for Anatidae species are based on Miyabayashi & Mundkur (1999) and have been redrawn by Ms. Colette Hall (Wildfowl & Wetlands Trust), while boundaries for crane populations are based on Mirande & Harris (2019). Additional draft maps have been made by volunteers, principally Ms. Sirui Ye and Ms. Tímea Kocsis and ourselves.

Maps have been produced as per the following steps:

1. Initially, the BirdLife International Data Zone has been used to indicate broad distribution of the species as a useful starting point for determining the boundaries of populations.
2. Additionally, observational data (Asian Waterbird Census (AWC) data, online observation portals such as eBird[6], Important Bird and Biodiversity Areas[7] for the species) have been used to cross-check the distribution of the species/population.
3. Regional, national and group specific field guides were reviewed for more detailed distribution information and to distinguish population distributions.
4. A variety of research publications and online tracking sites were reviewed to assess distribution based on tracking studies and movements of colour marked birds, tracking by satellite tracking and geolocators.
5. Maps have been reviewed and finalised through an international consultation process with experts.

[6] https://ebird.org/map

[7] BirdLife Data Zone > search for the species > Data table and detailed info > Important Bird and Biodiversity Areas table

References

As stated above, the BirdLife International Data Zone, e-Bird and AWC reports has been used to create the first draft boundary and these data sources are not mentioned for any population. A citation to other major references that contribute to delineation of the populated are provided.

Quality

During the CSR1 process, the following three codes have been proposed:

1. Based on **poorly studied/uncertain ranges with greater uncertainty** concerning separation of populations during breeding or non-breeding period when the population can be best distinguished.
2. Based on basic distribution information during breeding and non-breeding period, with **some information from movements** of marked individuals, genetics, isotope and/or morphological differences.
3. Based on **extensive knowledge of population** during breeding and non-breeding period, including results from movements of marked individuals, genetics, isotope and/or morphological differences or distinct subspecies.

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