Integrated monitoring of coastal waterbird populations along the East Atlantic Flyway

Framework and programme outline for Wadden Sea and other populations

PROGRAMMA NAAR EEN RIJKE WADDENZEE

THE WADDEN SEA FLYWAY INITIATIVE

Wetlands INTERNATIONAL

BirdLife INTERNATIONAL

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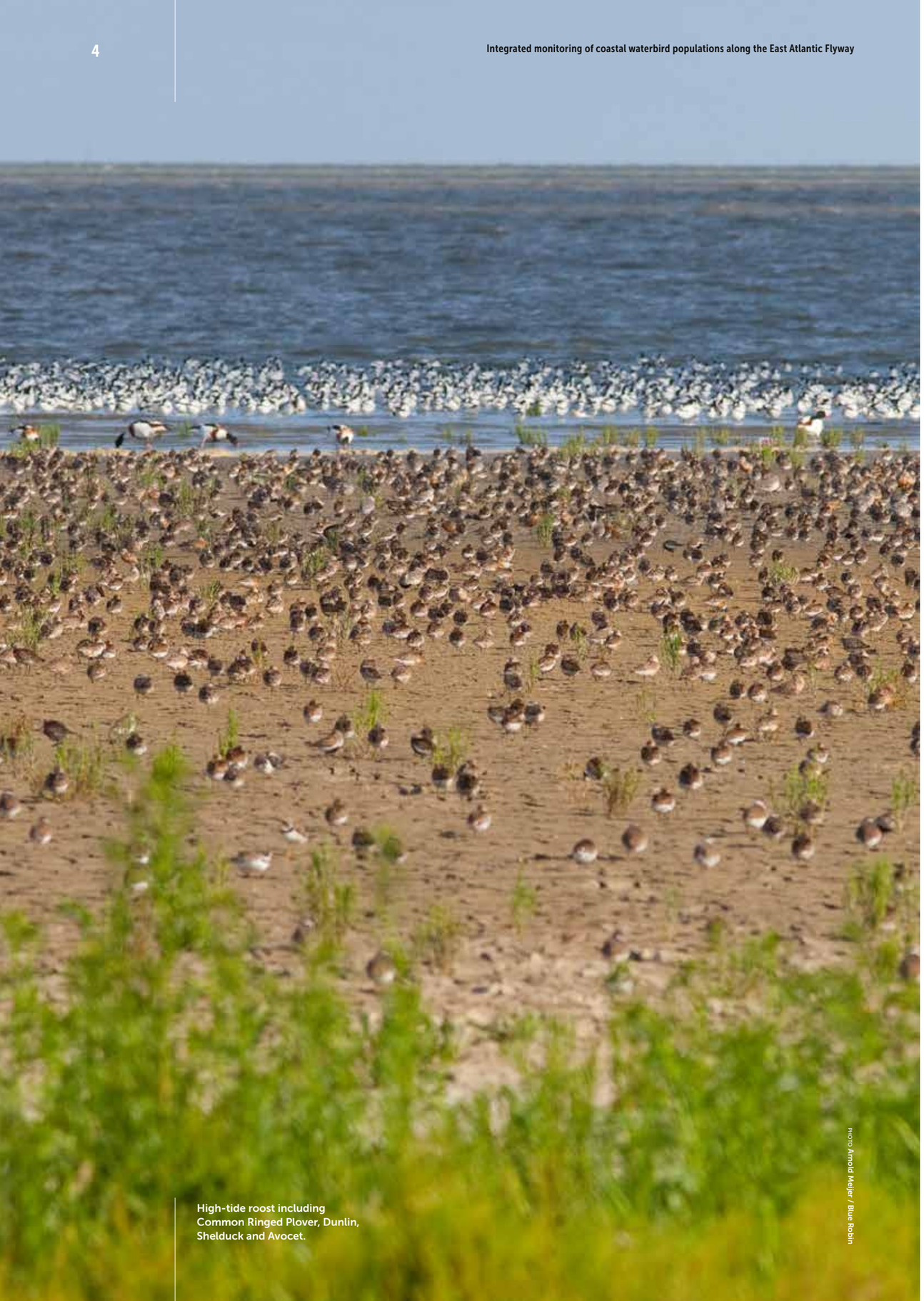
Contents



High-tide roost including Common Ringed Plover, Dunlin, Shelduck and Avocet.

PHOTO Arnold Meijer / Blue Robin

Foreword

This is a most welcome publication given its comprehensive and clear way of describing the reasons why monitoring, in all its aspects, is so important. Monitoring is the best tool to determine changes in populations, for the worse or for the best. Within the East Atlantic Flyway, in which the Wadden Sea plays a crucial role, most countries have themselves committed, through their membership of a number of international treaties such as Ramsar, AEWA and WHC, to keep populations in a favourable status; thus for 'the best'! That is a responsibility that cannot be ignored and it needs monitoring.

Obviously 'a favourable status' is different for every species and therefore difficult to define in simple figures. Still it is the joint responsibility of all countries within the flyway to determine and keep track of what happens with populations, breeding, passing through or wintering and why something happens if certain trends become visible. Measuring trends, and thus having a good long term monitoring programme, is important to provide the basis for relevant conservation and management measures. Governments often have difficulties to accept a long term commitment to support and provide sufficient resources to secure implementation of a monitoring programme although we all know it is essential for their conservation policy.

This is particularly the case for programmes at a flyway level with such a wide range of different countries with a great variety of available resources, expertise, staff and/or volunteers to implement the necessary, often difficult, fieldwork. It is therefore encouraging to see the positive attitude of especially the Wadden Sea countries in cooperation with BirdLife and Wetlands International to support monitoring in the entire East Atlantic Flyway through a well-defined strategy and programme. Especially providing the resources to be able to count all important areas within a relative short period in January 2014, has been a first major achievement; for long it was a strong wish to organise such a count and hopefully it was not the last time!

The present 'Framework and Programme outline' provides the information on 'what, where and how to monitor and investigate'. Together it is a good and reliable basis for governments and NGO's to provide resources in the years to come to keep track of what happens with migratory birds within the East Atlantic Flyway.

Dr. Gerard C. Boere
Chair Advisory Board
Wadden Sea Flyway Initiative

Foraging Bar-tailed Godwit, non-breeding plumage.

PHOTO Arnold Meijer / Blue Robin

Summary

The Wadden Sea is a very important breeding, moulting, staging and wintering site for migratory waterbird populations in the East Atlantic Flyway. However many of these populations are in decline. For policy and management, to improve the conservation status of these populations, knowledge is needed, not only from the Wadden Sea itself, but also from the other sites these populations use during their annual cycle, which can stretch from the high Arctic to deep into Africa. This report provides a framework and programme outline for integrated monitoring of these populations along the flyway.

This monitoring will provide an early warning of populations in need of conservation measures. It will enable the pinpointing of sites, periods of the yearly cycle and likely drivers responsible for the deteriorating conservation status of the populations and it makes evaluation of the effectiveness of policy and management measures taken possible.

To achieve this, the monitoring programme needs to collect data, at site and international (flyway) level, of abundance, vital rates and environmental conditions and analyse the interactions between these, it will consist of:

- Enhancing flyway monitoring of the population sizes and trends of the coastal waterbird populations through the International Waterbird Census (IWC) in the East Atlantic Flyway. Flyway trends and population sizes are essential baseline information for defining conservation priorities and identifying important sites, and provide context values for the interpretation of national and local developments;

- Improving site monitoring of coastal sites which are important for waterbird populations in the East Atlantic Flyway, through enhancement of the Important Bird Areas (IBA) programme. This will focus on the monitoring of bird numbers, the state of their habitats, human use and pressures and the existence of conservation measures;

- Enhancing vital rates monitoring through establishing a platform for the international coordination and joint reporting and analysis of demographic data relating to coastal waterbirds throughout the East Atlantic Flyway. This will enable the identification of the drivers of population trends by bringing together currently dispersed and largely unpublished data;

- Expanding and improving the integration, availability and communication of the results of this waterbird monitoring in the East Atlantic Flyway for different stakeholders needing this information for management and policy.

This programme is intended as a platform for cooperation among existing organizations; there is no intention to create a new organization. It builds on existing initiatives and aims to give added value through bringing together information which is valuable for many stakeholders. It will not be possible to raise funding centrally for all initiatives needed, including the collection of vital rates, count data and environmental data at the national level. It is proposed that funding needs to be found for international coordination among research groups and institutions involved in the kind of monitoring described in this programme. An exception is made for abundance and environmental monitoring in coastal Western Africa, which is currently a gap in the possibilities for flyway analyses. For this region the programme aims to raise funding to support local initiatives to improve the basis for monitoring. It is hoped that this programme can grow through time as more initiatives will join. Besides Wadden Sea populations, many other waterbird populations using sites in the East Atlantic Flyway will benefit from the same monitoring programme.

Juvenile Sanderling cleaning shellfish on the beach.

PHOTO Arnold Meijer / Blue Robin

Acknowledgements

"In an ideal world, all monitoring programmes would be designed on the basis of sound statistical principles with appropriately stratified random sampling and sufficient sample sizes determined from prior power analyses (Bart et al. 2000). In a pragmatic world, monitoring programmes rely on harnessing the efforts of (often pre-existing) local groups and enthusiasts in collaboration to derive information on the parameters of interest (Robinson et al. 2005)".

The Programme Rich Wadden Sea in The Netherlands financed by the Ministry of Economic Affairs of the Netherlands is thanked for taking the step and providing funding to improve waterbird monitoring along the East Atlantic Flyway as part of the Wadden Sea Flyway Initiative, of which this report is one of the outputs. Kees van Es and Wim Schoorlemmer are thanked for their role in this. Manon Tentij and Bernard Baerends from the Programme Rich Wadden Sea, responsible for the theme "International connectivity of the Wadden Sea", are very much thanked for their stimulating guidance throughout this work.

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1. Introduction

PHOTO Arnold Meijer / Blue Robin

Dunlin, Avocet and Shelduck searching for a roosting place.

- The Wadden Sea is one of the largest sites for coastal waterbirds in the world and many conservation and management measures are in place (Marencic & de Vlas 2009). However many of these populations, within the Wadden Sea, are in decline (Laursen *et al.* 2010, van Roomen *et al.* 2012, JMBB 2013) and their conservation status is reason for concern.

- As most of the populations of concern are migratory, knowledge from a much larger area than the Wadden Sea itself is needed to advise policy and management. The geographic region used by typical Wadden Sea waterbird populations extends from the Arctic where many of them breed to the tropical wetlands in Western Africa were many populations spend the northern winter (van de Kam et al. 2004). The total geographic range used by these populations is called the East Atlantic Flyway (Boere & Stroud 2006).

PHOTO Arnold Meijer / Blue Robin

- Important new attention to the embedding of the Wadden Sea within the international flyway is given after the inscription of the Wadden Sea as a World Heritage Site in 2009 with the recommendation *'to strengthen cooperation on management and research activities with States Parties on the African Eurasian Flyways'*.

- During a workshop in 2011 in Wilhelmshaven with stakeholders, it was recommended, among others, to develop an integrated monitoring programme along the East Atlantic Flyway (Boere & van Roomen 2011). The present document is the next step in the establishment of such a programme.

- This program aim to benefit the conservation of coastal Wadden Sea populations along the East Atlantic Flyway by enhancing, expanding and integrating existing monitoring to provide a strong information base for effective and efficient conservation policy and management.

PHOTO Arnold Meijer / Blue Robin

The twice a day emerging mudflats is the prime foraging habitat for the majority of coastal waterbird populations.

- As at the same sites as used by Wadden Sea populations also many other populations occur and many of the methods used will include assessment of these sites and include measurements of the other populations as well, this plan will also benefit the monitoring of many other waterbird populations.

- The principal aims of this document are to:
  - Identify the information needs which can be covered by monitoring results;
  - Describe the current state of monitoring along the East Atlantic Flyway against the information needs and identify gaps;
  - Describe a framework and working programme enhancing the integrated monitoring of coastal waterbird populations along the East Atlantic Flyway benefitting conservation and management.

- Besides this document focusing on the East-Atlantic Flyway as a whole, a further implementation document for West Africa has also been prepared concentrating on the implementation of abundance and environmental monitoring at the important coastal sites along the Atlantic coast of Africa (van Roomen et al. 2014).

PHOTO Arnold Meijer / Blue Robin

Eurasian Oystercatcher, still common but strongly decreasing.

PHOTO Dave Montreuil

Roosting Common Terns, Grey Pover and Common Ringed Plover.

2. Definitions

PHOTO Arnold Meijer / Blue Robin

Monitoring of both bird numbers (Eurasian Spoonbill in this case) and (potential) human induced pressures are important elements of this framework.

2.1 Which species and populations

- The populations of waterbird species included in this plan are those occurring in internationally important numbers in the international Wadden Sea area and typically using estuarine habitats to a large extent (n=40, Appendix 1). Secondly, waterbird populations are included which largely overlap with the Wadden Sea populations along the East Atlantic Flyway in the same estuarine sites (n=27, Appendix 1). In addition to these populations many other populations occur partly at the coastal East Atlantic Flyway as well but their full range involves many inland sites, more offshore sites or they are more typical of other flyways outside the geographical scope of this plan. Part of the work described in this plan will benefit the monitoring of these populations as well but only as a contribution to other efforts needed for these populations.

2.2 Geographic coverage

- The geographic region included under this plan includes the coastal zone of all countries where the waterbird populations of the Wadden Sea (as defined in Appendix 1) occur in important numbers during their annual cycle (breeding, migration, wintering). These countries (belonging to the Arctic, Western-Europe and Western Africa, n=39), are listed in Appendix 2.

2.3 Types of Monitoring

- Monitoring has been defined as "the systematic measurement of variables and processes over time for a specific reason" (Spellerberg 2005). With reference to the current plan, the specific reason could be described as "assessing whether the populations of interest remain in a healthy, viable state", and if this is not the case "assessing where, when and why the viable state is under threat". In this plan we define four (partly overlapping) types of monitoring. The links and hierarchical relationships between these are visualized in Figure 1.

Abundance monitoring

- Abundance monitoring consists of the regular assessment of waterbird numbers within sites or across sites in the whole flyway.

- Outside the breeding season, abundance monitoring based on counts can be divided as follows:

PHOTO Koos Dansen

PHOTO Bernd de Bruijn

Left:Sandwich Tern in breeding colony.

Right: Doing field work: contributing to abundance monitoring.

  - To monitor the abundance of populations at the flyway scale, coordinated simultaneous counts are organized in January (or other specific months in a minority of populations), at all key sites and as many additional sites as possible across their whole non-breeding range;
  - To monitor the importance of sites, several counts are organized at regular intervals during the year, focusing on the monitoring of maximum numbers or average numbers across the year. Timing and frequency of counts needed depend on the position of the sites in the flyway, the phenology of the species making use of the sites and the specific aims of the monitoring program. Linking a monitoring programme focussing on site importance also to flyway monitoring is possible by including a January count in the monitoring scheme.

- Within the breeding season, different methods are used to monitor abundance as well:
  - To monitor the abundance of common dispersed breeding species mostly a sampling approach is used by counting breeding birds at selected plots, transects or points. Based on the representativity of the samples the results will reflect the changes in numbers of the whole population. When density of breeding birds is measured also extrapolation to total population size becomes possible;
  - To monitor the abundance of concentrated breeding species (in colonies) or rare breeding species mostly counts of all breeding sites or al least the most important ones are required.

Vital rates and demographic monitoring

- Vital rates monitoring is the regular collection of data on productivity and survival, for example by recording the hatching and fledging probabilities of breeding birds' eggs and young, by observing the proportions of juvenile birds in migrating and wintering flocks, or by using ringing and mark-resight studies to estimate survival.

PHOTO Arnold Meijer / Blue Robin

PHOTO Arnold Meijer / Blue Robin

Left: Measurements of breeding succes is an important contribution to vital rate monitoring, on the photo clutch of Oystercatcher eggs.

Right: Turnstone.

Small scale collection of mariene resources on mudflats.

- Vital rates monitoring and abundance monitoring link together (usually through the use of population models) to form demographic monitoring. It aims to uncover the drivers behind changes in abundance, to increase the possibilities for early warning and enables prediction of future population change.

Environmental monitoring

- Environmental monitoring is defined as the regular and standardized recording of information about (a) the (a)biotic characteristics of sites, (b) anthropogenic pressures on sites and (c) conservation measures at sites. It enables following changes in ecological characteristics, changes in the type and abundance of pressures and following investment in conservation measures.

Integrated monitoring

- Integrated monitoring involves the regular joint, integrated analysis of data collected by the monitoring of abundance, vital rates and environmental conditions and pressures. Its aim is to further knowledge causes of population change of waterbird populations. It links the abundance and demographic monitoring to changes in ecological characteristics of the sites, human pressures and conservation measures.

PHOTO Bernd de Bruijn

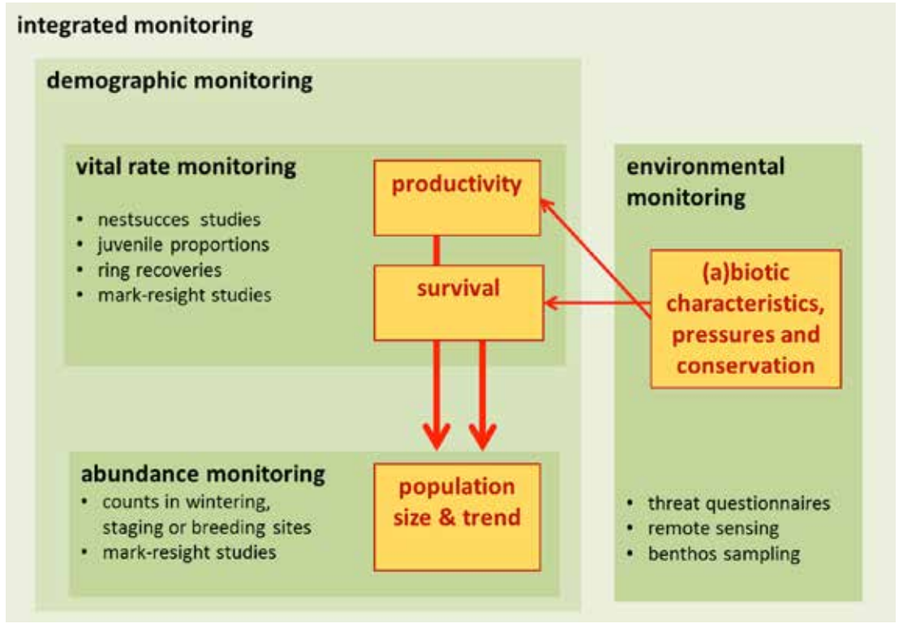


Figure 1. *Different types of monitoring as defined in this report, their relations and examples of techniques to collect the data.*

3. Information needs

3.1 Why monitoring

- Data and information about waterbird numbers and trends, and about the causes of changes in these parameters, are needed by a wide variety of organizations and institutes both governmental and non-governmental, at local, national and international levels.

- Much national and international legislation aims to maintain (water)bird populations in a favourable conservation status, and monitoring is needed to evaluate this status, often in relation to questions of the causes of change and the effectiveness of conservation measures and policy (see figure 2).

- National and international legislation are also asking for impact assessments when economic developments can potentially influence the status of (water)bird populations and their sites. For these assessments monitoring data is needed to judge before the likely magnitude of the impact and to follow the real impact during and after the economic development is carried out.

- Waterbirds are also good bio-indicators for the quality of the sites they use, giving information about the state and changes of their environment. Monitoring of waterbirds is a quick and cost-effective way of making a general assessment of environmental conditions and changes in these conditions.

Figure 2. *The role of monitoring within the management cycle to start management actions, to evaluate management actions and to change management actions ('learning by doing').*

3.2 The need at different geographic scales

Site level

- Site Managers need to know the environmental conditions and pressures at their site and which conservation measures are working and which not. All these information needs require monitoring.

- In order to set priorities for conservation and management, site managers need to know the proportion of each flyway population held by their site at different times of the year, and which of these populations are increasing, stable or decreasing at the site .

- Site managers also need to know whether the causes of changes are local at their site or located elsewhere on the flyway. The comparison of the trends at their site with trends at other sites and with the overall trend in the whole flyway is a first step to answer this question (see figure 3).

- In cases of management and conservation measures taken at the site, it is important to monitor the effects of these measurements on the conservation status of species and part of the site targeted.

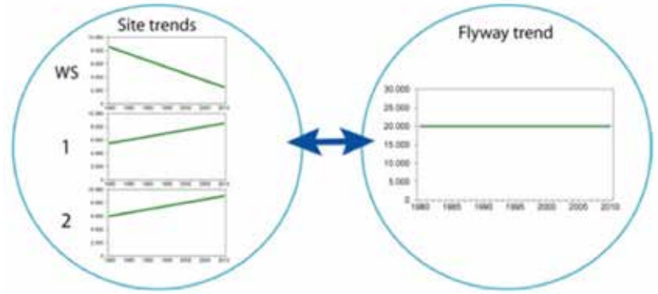


Figure 3. *Hypothetical trends at three sites (left) in comparison with the flyway trend (right). If a site trend (WS) differs substantially (more decrease in this case) from other sites in the flyway and the overall flyway trend it is likely that local factors are driving the difference. Also if the site trend is decreasing and at the same time the flyway trend is not, it means that despite the decrease at the site the overall conservation status of the species is not unfavourable and redistribution of the species along the flyway is most likely taking place.*

National level

- Many governments have signed Multilateral Environmental Agreements (see Table 1) and most of these Agreements and international legislation, which are legally binding, have formal reporting mechanisms requiring government agencies to submit National reports based on monitoring data.

- For national nature conservation policies and management, government agencies and national NGOs need knowledge of the national and international conservation status of waterbirds and their sites as a basis for decisions about policy and management priorities.

PHOTO Dave Montreuil

Roosting Lesser Black-backed Gulls and Caspian Terns, also cormorants in the background.

- National-level practitioners need information about the causes of changes, and whether these are positioned in their country or outside.

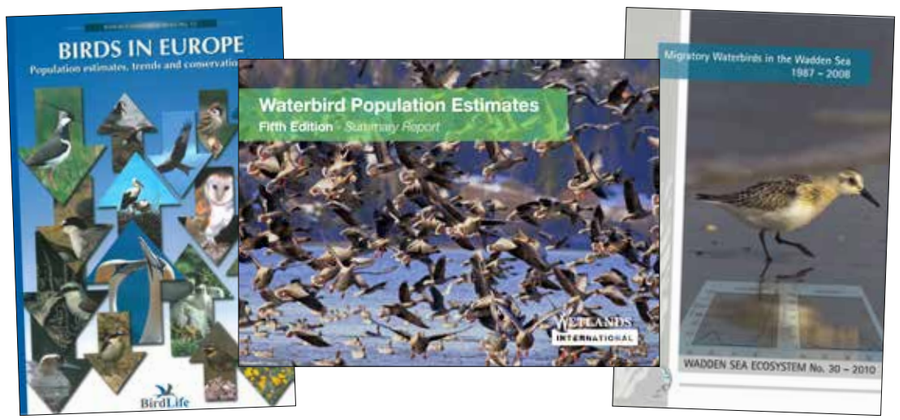
- In cases of national management and conservation measures taken, it is important to evaluate these to justify investment of resources, to evaluate success and to steer future efforts.

International level

- The Multilateral Environmental Agreements and international legislation (see Table 1) are best suited to provide advise about global, continental and flyway wide conservation priorities based on assessments of the conservation status. This information is important to steer national and site level conservation to ensure that these local and national efforts are worthwhile in the international context. These international assessments can only be carried out on the basis of monitoring data provided from national and site level.

- Monitoring of Waterbirds provide important input to several international assessments. Important ones are the Waterbird Population Estimates (WPE) which is especially connected to giving advise about 1% thresholds for designating sites of international importance (Ramsar sites, N2000 sites). The Conservation Status Report on waterbirds in Africa-Eurasia (CSR) which is prepared for the African Eurasian Waterbird Agreement under the Convention of Migratory Species and provide advise about populations in Africa-Europe with an unfavourable conservation status. The art. 12 assessments under the EU Birds Directive giving an overview of the conservation status of birds in the EU. See table 2 for a timeline of these outputs.

- Other international outputs which also require data about waterbird numbers and trends are the IUCN Red List for global biodiversity, the BirdLife assessments of conservation status of birds in the whole of Europe (Birds in Europe projects), the WNF living planet index and the CWSS quality status report about the international Wadden Sea.



Examples of international publications on the status of bird populations.

Table 1. *Multilateral Environmental Agreements and international legislation affecting the East Atlantic Flyway which require monitoring data for their effective implementation*

Convention on Biodiversity (CBD)
African-Eurasian Migratory Waterbird Agreement (AEWA)
Ramsar Convention on Wetlands
Convention for Co-operation in the Protection and Development of the Marine and Coastal
Environment of the West and Central African Region (Abidjan Convention)
The EU Birds Directive.

Table 2. *Long-term timeline of output including waterbird monitoring data for international conservation initiatives. WPE is the global Waterbird Population Estimates, CSR is the Conservation Status report of waterbirds in the AEWA region and Art12 is the reporting under EU Birds Directive. The exact timing of certain outputs may change in the future.*

Instrument	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Ramsar			WPE 6			WPE 7			WPE 8			WPE 9
AEWA		CSR 6			CSR 7			CSR 8			CSR 9	
EU	Art12						Art12					

3.3 The need for different types of monitoring

Abundance monitoring

- Abundance monitoring is the basis for several information needs. It enables prioritization in conservation effort of species, it enables prioritization of sites conservation and it enables the comparison of trend directions on different spatial scales helping in detecting the causes of trends (see figure 3).

- To assess flyway population sizes and trends, periodically (once in 3-6 years), depending on the species, all the key sites in the East Atlantic Flyway should be counted during January or all the breeding sites should be surveyed. Simultaneous effort is important, so that doubts can be avoided that changes in numbers are caused by redistributions rather than changes in population size.

- To assess site importance and trends, preferably yearly repeated counts are needed (both breeding and non-breeding birds). For non-breeding birds several counts a year are needed to cover the different phenological patterns of the migrants visiting the site.

Vital rates and demographic monitoring

- Data on productivity and survival will help in finding the mechanisms behind the trends in bird numbers and can act as early warnings for changes in bird numbers (see Box 1).

- Improvements in the availability of vital rates and the use of population modelling techniques to combine these with abundance monitoring towards demographic monitoring will increase the usability of sometimes fragmented information and enables the combined assessment (van der Jeugd et al. 2008, van der Jeugd et al. 2014) .

Monitoring of environmental conditions, pressures and conservation measures

- The principal reason for collecting data about the condition of sites and the threats they face is the need to understand what is happening to them in order to formulate appropriate conservation actions. Knowledge of threats across the flyway will also help to understand changes at flyway scale.

Integrated monitoring

- The integration of demographic monitoring with environmental monitoring is a key requirement for species conservation programmes as it links the change in numbers and the mechanisms of change (vital rates) with the direct causes of these changes; the ecological conditions of the sites, the anthropogenic pressures and the conservation efforts.

PHOTO Arnold Meijer / Blue Robin

Colourrings make observations about individual movements and survival possible. In this case individual marked Eurasian Oystercatcher.

- Through this linking with environmental conditions, integrated monitoring can provide much improved understanding of changes in bird numbers and distribution, and of the causes underlying these changes (Piersma 2012).

3.4 The need for communication of results

- The need for more diverse and comprehensive monitoring data, compiled efficiently at different geographic scales, is matched by the need for improved communication of the results of this monitoring.

- There are different audiences for this information, from politicians and policy makers towards managers of sites, scientists, persons carrying out the monitoring as volunteer or professional and the general interested public. The communication output should be tailor made for these different audiences.

- Besides different audiences also different ways of communication are needed from websites towards articles and reports to newspaper items.

- For policy makers and decision takers comprehensive indicators of progress towards goals and indicators of failure or success of measures taken are needed.

- For site managers practical translation of results needed for site management are required. Which sites, species and habitats are in need of increased conservation, what are the pressures, which results are reached with current management and what is not working.

- All results should be scientific credible, resulting that advise given to decision makers and site managers is evidence based. To allow for critical review within the scientific community results should be published and peer reviewed.

- The satisfaction, goodwill and participation levels of participants in the monitoring are maximized by providing timely and appropriate feedback of results.

- For the general public effective communication requires important storylines in simple, appealing, engaging publications.

PHOTO Hans Schekkerman

The counting team of the Banc d Arguin, Mauritania, January 2014.

BOX 1

The added value of demographic and integrated monitoring

Currently, monitoring of waterbird populations is for most species restricted to repeated assessment of numbers of birds, either in important sites or across a flyway. Any changes in numbers observed in this way must be caused by changes in either **reproductive output** or **mortality/survival** of individuals making up the population. If a local subpopulation of the flyway population is monitored, an additional possible cause is a change in the balance of **immigration/emigration** from and to other sites within the flyway. These demographic processes, also called 'vital rates', are the mechanistic drivers of population change. Two important reasons why collecting information on these vital rates, in addition to information on numbers (thus extending 'abundance monitoring to 'demographic monitoring', see fig. 1), is of value to management and conservation, are (1) that it is a prerequisite for identifying causation, and (2) that it may enable earlier detection of relevant changes.

Causation

When abundance monitoring reveals a change in population size, the question arises whether this should give rise to concern and eventually to management or conservation actions. Is the change a phenomenon that may affect long-term population a viability or just a transient 'natural' variation? Do man-induced changes play a role? Which countermeasures will be effective? All these questions revolve around the cause of the observed change. Identifying which vital rate(s) drives it is a necessary first step towards identifying this cause: it narrows down the possibilities by focusing attention to specific times of year, and in migratory animals also on specific geographic regions (e.g. breeding vs. migration/wintering range). It is therefore also key to the planning of more in-depth studies into causal mechanisms. Sometimes, a local or global pressure may have already been identified, and be suspected to relate to the change. Linking such pressures mechanistically to changes in specific vital rates and demonstrating that these indeed take place strengthens the scientific case necessary to convince authorities to take specific actions in the face of costs and opposite interests.
An example is the 70% decline since the early 1990s of the population of Red Knot *Calidris canutus rufa* migrating along the Atlantic seaboard of the Americas. This decline has been linked to overfishing of Horseshoe Crabs, leading to a strong reduction in the Knots' primary food source during their ultimate spring migration stopover on the beaches of Delaware Bay, before the flight to their arctic breeding grounds. Field data showing that the ability of Knots to build up fuel stores here depends on crab egg abundance, and that their annual survival rate is related to the size of these fuel stores, have been crucial in the ongoing political and legal process towards limiting the crab harvest (Baker et al. 2004, Niles et al. 2009, McGowan et al. 2011). As in this case not only the numbers and demography of the red knots were monitored, but also the abundance and the harvest of horseshoe crabs, it can also be called an example of integrated monitoring in the sense of fig. 1.

Early warning

The basis of the process leading to management or conservation measures is the detection of change. Because population counts are subject to short-term fluctuations, caused by both environmental effects and by counting errors, it necessarily takes time to distinguish systematic changes from such stochastic variation, in order to not 'raise the alert' unnecessarily. Earlier detection of change allows more time to evaluate it, identify its cause and develop remedial action if necessary. Here, demographic monitoring is helpful in two ways. First, in long-lived animals (which many waterbirds are), breeding population size may respond to changes in vital rates only after several years, for instance due to the existence of a non-breeding surplus. A relevant change may thus be detected in a vital rate before it can be detected in the population size. Second, demonstrating changes in vital rates that are consistent with observed changes (trends) in count data reduces the likelihood that the latter arose from counting errors, and therefore enables earlier assessment of a trend as 'significant'.

PHOTO Arnold Meijer / Blue Robin

Red Knots, important evidence on the relation between feeding conditions during migration and survival have been shown in this species.

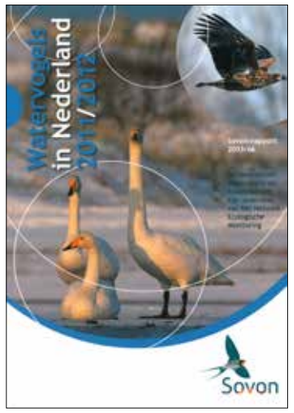
4. Current status of waterbird monitoring

PHOTO Dave Montreuil

Pelicans, large fish eating birds together with a Caspian Tern.

4.1. Collection, analysis and reporting of abundance data

- Waterbird abundance data for flyway monitoring (January counts and in Africa also July counts) are compiled at site level by national coordinators and submitted to Wetlands International as contribution to the International Waterbird Census for international level analysis (e.g. Gilissen et al. 2002, Wetlands International 2013).
- Site level data of Important Bird Areas (both breeding and non-breeding birds) are also submitted to BirdLife International by national BirdLife partners in the framework of international IBA monitoring (BirdLife International 2014).
- A web portal, The *Critical Site Network Tool*, provides an online platform for communicating results of Waterbird monitoring in Africa-Eurasia. It contains information both from the International Waterbird Census and the Important Bird Areas programme.
- Abundance data of non-breeding waterbirds for site and national level monitoring (several counts a year) are collected and reported in many countries (e.g. JMMB 2012, Hornman *et al*. 2012, Holt *et al*. 2011, Keller & Burkhardt 2011).
- Abundance data for many common and dispersed breeding (water)bird species are collected, analysed and published within Europe by the European Bird Census Council (PECBMS 2013).
- Based on the combined information from breeding and non-breeding waterbird monitoring once in three year a Conservation Status Report about Waterbirds in the African-Eurasian region is published and a global Waterbirds Population Estimates report by Wetlands International.
- Once in 6-10 years the status of European birds (including all waterbirds, both breeding and wintering) are assessed in the so called Birds in Europe projects organized by BirdLife International (BirdLife International 2004).
- Colony breeding waterbirds and seabirds at the coast of West Africa are monitored on project basis in recent years (Veen *et al*. 2011).
- For a selection of species with a high density of colour marked individuals and a high effort of recording of these marked birds, estimates of total population size are calculated (Spaans *et al*. 2011).



Examples of national reports on waterbirds and wetlands

4.2 Collection, analysis and reporting of vital rates data

- Demographic data are collected, analysed and reported by a number of scientific institutes and groups. Although volunteers and students contribute to many of these studies, most also involve major investments in professional staff and logistics and materials, for both the fieldwork and data analysis. Some of this work is part of governmental monitoring programs, but much is also funded through sources for scientific research.
- The Trilateral Monitoring and Assessment Program (TMAP), undertakes monitoring of breeding productivity of key breeding species in the international Wadden Sea.
- The Arctic Birds Breeding Conditions Survey (ABBCS) brings together information on breeding conditions and breeding performance of waterbirds at several locations in the Arctic, contributed by a variety of expeditions and research projects (Soloviev & Tomkovich 2003, www.arcticbirds.net).

PHOTO Arnold Meijer / Blue Robin

Bar-tailed Godwit.

- An extensive research programme collecting also demographic parameters (especially survival) for a selection of species, is the Global Flyway Network (e.g. Piersma 2006). The network conducts studies of Red Knot *Calidris canutus*, Bar-tailed Godwit, *Limosa lapponica* and Sanderling *Calidris alba*.

PHOTO Arnold Meijer / Blue Robin

Making use of small boats to reach outer sandbanks for doing counts is often needed.

PHOTO Dave Montreuil

Common Tern, Grey Plover and Ringed Plover, all in non-breeding plumage.

- Based on the extensive databases on ringed and recovered waders in countries such as the UK, France and The Netherlands, mainly brought together by volunteer ringing groups, coordinated by national ringing centers and coordinated within Europe through EURING, several species have been or could be analysed with regard to patterns in reproduction and survival.

- An overview on the availability of studies which currently provide data on reproduction and/or survival for populations which make use of the Wadden Sea that could contribute to vital rates monitoring in the East Atlantic Flyway are summarized in Table 2 (more details in van Roomen et al. 2011). For a number of Dutch Wadden Sea populations current knowledge on trends in survival and reproduction are summarized in van der Jeugd *et al.* 2014.

4.3 Collection, analysis and reporting of environmental monitoring

- BirdLife International has developed a systematic approach to describe and monitor pressures and conservation actions on sites as part of their Important Bird Areas (IBA) programme (BirdLife International 2006).

- Data on human pressures and conservation measures on sites are compiled at country level by national coordinators under the IBA programme and reported to the World Bird Database. Sometimes also national reports have been produced (for instance Sanou 2008).

- Other studies of pressures at sites are many and varied, and already provide important data which help identify environmental factors affecting population change in waterbirds, including climate change (e.g. Maclean et al. 2008), eutrophication (e.g. Macdonald 2006), fisheries (e.g. van Gils et al. 2006), human disturbance (e.g. Rogers et al. 2006), infrastructure development (e.g. Benitez-Lopez et al. 2010) and introduction of non-native species (e.g. Troost 2010).

- Within the TMAP project for the Wadden Sea, comprehensive monitoring of various important parameters is carried out giving an overview of the environmental factors and pressures. Every six years this information is summarized in a Quality Status Report.

- At several sites along the East Atlantic Flyway also detailed monitoring of food resources for waterbirds feeding on benthos is carried out (e.g. Compton et al. 2013).

Table 2. *Availability of information (number of studies, ranges indicate incomplete information) on reproduction and annual survival for flyway populations of coastal waterbird species important in the international Wadden Sea and covered in current report. Populations are marked 'x' under 'Both' if both reproduction and survival are covered by at least one study.*

Species	Population	Reproduction	Survival	Both
Great Cormorant	sinensis, N, C Europe	3	2	X
Eurasian Spoonbill	leucorodia, E Atlantic	2	1	X
Barnacle Goose	N Russia, E Baltic (bre)	1	1	X
Brent Goose	Bernicla	1	1	X
Brent Goose	hrota, Svalbard, N Greenland (bre)	1	1	X
Common Shelduck	NW Europe (bre)	0	0	
Eurasian Wigeon	NW Europe (non-bre)	2	0	
Northern Pintail	NW Europe (non-bre)	1	0	
Common Eider	mollissima, Baltic, Wadden Sea	3	2	X
Eurasian Oystercatcher	Ostralegus	7	4	X
Pied Avocet	W Europe (bre)	3-5	0-2	
Common Ringed Plover	Hiaticula	1	1	X
Kentish Plover	E Atlantic, W Mediterranean	1	1	X
Grey Plover	squatarola, E Atlantic (non-bre)	0	0-1	
Red Knot	Canutus	2	1	X
Red Knot	Islandica	1	1	X
Sanderling	E Atlantic (non-bre)	1	1	X
Curlew Sandpiper	W Africa (non-bre)	1	0	
Dunlin	Alpine	1	1	X
Dunlin	schinzii, Baltic (bre)	2	2	X
Bar-tailed Godwit	Lapponica	0	1-2	
Bar-tailed Godwit	taymyrensis, W, SW Africa (non-bre)	0	1	
Whimbrel	phaeopus, NE Europe (bre)	0	0	
Eurasian Curlew	Arquata	1	1	X
Spotted Redshank	Europe (bre)	0	0	
Common Redshank	Robusta	0	0	
Common Redshank	totanus Northern Europe (breeding)	2	1-2	X
Common Greenshank	NW Europe (bre)	0	0	
Ruddy Turnstone	interpres, Fennoscandia, NW Russia (bre)	0	0	
Ruddy Turnstone	interpres, NE Canada, Greenland (bre)	1	2	X
Black-headed Gull	West & Central Europe (bre)	4	4	X
Common Gull	Canus	1	3	X
Herring Gull	Argentatus	0	0-1	
Herring Gull	Argenteus	6-8	6-7	X
Sandwich Tern	sandvicensis, W Europe (bre)	2	0	
Common Tern	hirundo, N, E Europe (bre)	0	0	
Common Tern	hirundo, S, W Europe (bre)	4	3	X
Little Tern	albifrons, W Europe (bre)	0	0	

5. Assessment of status of monitoring against information needs

5.1 Gaps in abundance monitoring

- Recent surveys and time series about the number of waterbirds at coastal sites in the East Atlantic Flyway from January are only available from a relatively small number of countries, most of which are situated in Western Europe (Fig. 5). This results in flyway trends for Wadden Sea relevant populations being available for only a selection of populations (Fig. 6).

- The quality of abundance data currently available for conservation purposes is relatively low. The most recent status review of waterbird populations in the AEWA region (Nagy *et al*. 2012) presented population estimates for 98% of all waterbird populations on the AEWA list, but only 5% of these were classified as "census based", with 73% relying to a varying extent on expert opinion and 20% being "best guess" estimates.

- There is a need to expand beyond the current baseline of January counts. More frequent counts during the year will lead to a better understanding of seasonal changes in bird distribution and site usage, and will help identify bottlenecks and key sites in the birds' annual cycles. In several countries this information is available but not coordinated internationally and not available for international analyses.

- Trend data for a selection of breeding waterbird species are collected by the PECBMS program for Europe (PECBMS 2013) however, they mainly concentrate on common dispersed species. Colonially breeding waterbirds are often monitored on national level but not coordinated and brought together on international level although they are especially important in this framework. In West-Africa, a program for the monitoring of colonially breeding gulls, terns and seabirds is under development.

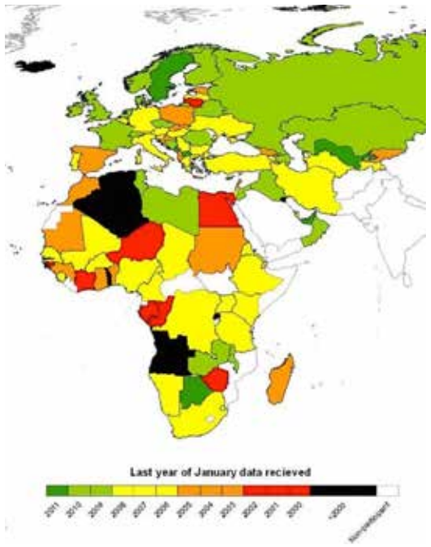


Fig 5. *Overview of the availability of Waterbird count data by country and year (situation 2012).*

5.2 Gaps in vital rates and demographic monitoring

- The demographic studies of waterbirds in the Flyway do not currently add up to a comprehensive international monitoring programme (covering all the vital rates) for most of the species, except for a very small number (van Roomen et al. 2011).

- More work is already being directed to monitoring of reproductive output than to monitoring of survival (Table 2). However, as breeding success may be more variable between different sites than survival, it is important to achieve sufficient spatial sampling coverage.

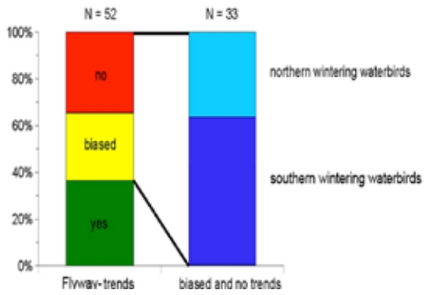


Fig 6. *Percentage of Wadden Sea Populations with flyway trends. Biased trends are based on only part of their wintering range. A high percentage of these trends can be improved with data from Africa (southern wintering waterbirds).*

PHOTO Dave Montreuil

Grey Plovers in non-breeding plumage.

- There is unused potential for monitoring variation in breeding output by assessment of age ratios on autumn migration stopovers or in wintering areas in wader species, gulls and some duck species. In many goose species such age ratio data are collected annually on a wide geographic scale and provide a very useful measure of the reproductive output of populations (Ebbinge *et al*. 2002).

- Existing monitoring of survival is less well spread across taxonomic groups than monitoring of productivity, with geese, Great Cormorant and European Spoonbill receiving most, ducks and terns least, and waders and gulls intermediate coverage (Table 2).

- The analysis of abundance data together with vital rates (demographic monitoring) is relatively new. This includes both the classical two-step analysis of data on reproduction and survival followed by the use of matrix population models and the comparison of the predicted population trajectories with the available count data, and the recently developed 'integrated population models' (Schaub *et al.* 2012) which integrate the demographic information contained in both population counts and data on vital rates in a comprehensive description of population development. An overview of potential for Wadden Sea populations is given in van der Jeugd *et al.* 2014.

5.3 Gaps in environmental monitoring

- Despite the running IBA program, for many important sites information about anthropogenic pressures and conservation actions is lacking or out of date. There is a need to increase the effort to collect this data and bring it together internationally. This is especially true in countries without national BirdLife partner.

- Much information about environmental factors is collected locally but it is difficult to get an overview for the sites along the flyway. On the other hand some information like availability of benthos or fish as food for waterbirds is often not monitored.

PHOTO Dave Montreuil

Grey-headed Gulls, a local species from West-Africa which will also benefit from increased monitoring along the flyway.

6. Framework and programme outline for integrated monitoring of coastal waterbirds along the East-Atlantic Flyway

PHOTO Arnold Meijer / Blue Robin

Eider Duck, female with young in the Wadden Sea.

6.1 Principles

- This programme is intended as a platform for cooperation among existing organizations; there is no intention to create a new organization.
- This programme builds on existing initiatives and aims to give added value through bringing together information which is valuable for many stakeholders.
- It will not be possible to raise funding centrally for all initiatives needed, including the labour-intensive collection of vital rates, count data and environmental data at the site and national level.
- It is proposed that funding needs to be found for international coordination among research groups and institutions involved in the kind of monitoring described in this programme.
- An exception is made for abundance and environmental monitoring in coastal Western Africa, which is currently a big gap in the possibilities for flyway analyses. For this region the programme aims to raise funding to support local initiatives to improve the basis for monitoring.
- Contributing to the programme should benefit both stakeholders making use of its results and the contributing research groups. The former benefit through the availability of flyway-wide data summaries and analyses. Contributing research initiatives benefit from the availability of comparable and complementary data for their study populations, adding to the scientific value and scope of their own data.
- It is hoped that this programme can grow through time as more initiatives will join. At present the goals for the improvement of abundance and environmental monitoring are seen as the first priority while international monitoring of vital rates will require more time.

PHOTO Dave Montreuil

Great Cormorant, subspecies *lucidus* in Western Africa.

6.2 Coordination, organization and governance

- A consortium will be responsible for planning and development of the programme. An appointed coordinator should keep the programme moving.
- BirdLife International and Wetlands International as coordinators of the IBA and IWC programmes, respectively will be important in this consortium.
- This consortium could be technically steered by the African-Eurasian Waterbird Monitoring Partnership, which enables synergies with the monitoring in other African-European flyways. This Partnership brings already together many stakeholders in the (international) monitoring of waterbirds and wetland sites like Wetlands International, BirdLife International, the AEWA Secretariat, EBCC, representatives of national coordinators and specialist groups.
- Further governance of the programme should be carried out by the funders of the programme.
- It is proposed that the vital rate monitoring should be organized more dispersed by several institutes who each take the responsibility for one or more populations of the target species. They would contribute information from these populations in the form of summarized data (e.g. annual estimates of vital rates).

6.3 Enhancement of abundance data collection and compilation

6.3.1 Non-breeding counts

- Simultaneous counts in January will be carried out along the whole East-Atlantic Flyway. In principle, annual coverage is the best way to achieve the assessment of flyway trends. In countries and regions where this is not feasible, a selection of (sub)sites will be counted annually and a simultaneous ‘total’ count once in three - six years, is aimed for.

PHOTO Dave Montreuil

Common Greenshank.

- For sites which are important during migration and moult, more frequent counts in a year will be organized and these data will be brought together internationally. This will allow a better understanding of the changing seasonal distributions of waterbird populations and the timing of peak numbers of different populations at different sites.

- Enhanced data collection and compilation will be achieved by stronger coordination of the programme, with improved communication of results as feedback to all participants.

6.3.2 Breeding season counts

Colonially nesting species

- A variety of target species and populations of the East Atlantic Flyway breed in colonies, where large concentrations of birds are relatively easy to monitor. Establishment of internationally coordinated monitoring of colonial waterbirds on the scale of Europe, Africa or along the whole flyway should be considered a priority in cooperation with other organizations. In Europe this could be the European Bird Census Council. In Western Africa, Birdlife International is coordinating a project on colonial breeding waterbirds and seabirds.

Common breeding birds

- Many European countries compile annual indices of common breeding birds and submit them to the Pan-European Common Bird Monitoring Scheme (PECBMS coordinated by the EBCC), where the national data are integrated and weighted to form 'European wild bird indicators'. Several waterbird species are included in these indices and it should be investigated how these methodology can also be expanded to other regions (Northern Africa for instance).

- With the Arctic Breeding Bird Survey (ABBS) as a basis, compilation of breeding bird densities in arctic regions should be continued.

Left:Breeding Arctic Tern.

Right: Common Redshank.

PHOTO Arnold Meijer / Blue Robin

6.4 Enhancement of vital rates monitoring

6.4.1 Species and populations

- Table 2 list species and populations of the Wadden Sea for which ringing, sometimes also colour-marking schemes and reproduction measurements already exist. In most cases the effort for these populations needs to increase and to be carried out more systematically to result in meaningful results on flyway level. In addition to already some good demographic monitoring (eq. Spoonbill, Brent Goose and Knot), more attention should be given to Pintail, Eider, Oystercatcher, Avocet and Sandwich Tern (van der Jeugd et al. 2014).

- Whether such studies will indeed be initiated will depend on the interest of research groups and the financial resources available to them; the budget of the current programme plan does not include the running costs of these research projects. However, the potential of these projects, also within the East Atlantic Flyway context, should serve as a stimulus and a recommendation to funding agencies and governments.

6.4.2 Monitoring of productivity

Studies on the breeding grounds

- Many studies in the temperate zone and the Arctic, collect data on clutch size, brood size and fledging rates and other breeding parameters. Submission of these data, or at least of metadata from these studies, to the groups responsible for a species/population will enable more integrated and comprehensive analyses for that species/population.

- Support should be given to the Arctic Breeding Bird Survey to continue the coordination of data collection in the arctic region.

- The JMBB project on breeding productivity of species within the Wadden Sea should be continued.

PHOTO Arnold Meijer / Blue Robin

Left: Barnacle Goose.

Right: Whimbrel.

PHOTO Kees Dansen

Studies on the non-breeding grounds

Visual recording of proportions of juveniles in flocks

- The Goose and Swan Specialist Groups (IUCN/WI) are collecting coordinated age counts of many goose and swan species in Europe to gain an understanding of variations in breeding success. Many more waterbird species (including waders, gulls and terns, and some ducks) can be aged in the field and similar coordinated age counts as in geese and swans will help in enhancing the availability of data on breeding productivity in these species.

- National coordinators would be asked to start to collect age ratio data from a selection of sites and species in their country. These data would then be brought together internationally and analysed. The methodology would be simple, but a high level of competence is required to accurately identify and count young birds in mixed flocks. A manual needs to be prepared and online available guidance is necessary (see for example Lemke et al. 2012 for Sanderling).

Recording of proportions of juveniles in birds trapped

- Data on ringed birds (including age) are collected by national ringing schemes and stored in their national databases and the EURING databank (EDB). These data could be compiled and analysed to provide annual productivity indices.

- To provide meaningful results in this, data from sites where every year on the same place a fair sample of target species is caught are most useful for this. Current places where this is achieved (eq. Schiermonnikoog in the Netherlands, Wash in United Kingdom) should be maintained and other places started.

Recording of proportions of juveniles in samples of shot birds

- In some countries (e.g. Denmark, UK) and for some species the collection of hunting statistics includes

PHOTO Arnold Meijer / Blue Robin

information gathering on age composition of the hunting bag, e.g. via wing surveys in which hunters send in wings of shot birds, from which their age (and sometimes sex) can be assessed. This data are also an important source for demographic monitoring, especially for some Duck species.

6.4.3 Monitoring of survival

- There are many studies, mainly in the temperate zones, where birds are trapped and marked with coloured leg rings, neck collars or similar conspicuous individual marks. These studies yield information about the movements of birds, and resighting data can be used to estimate survival (e.g. Clausen et al. 2001, Kraan et al. 2010, van der Jeugd et al. 2014, White & Burnham 1999).

- Institutions collecting such data will be asked to be responsible for a species/population, to maintain their own raw data and to contribute summarized results for flyway assessments.

- Internet based applications for read colour-marks will be stimulated to facilitate the reporting of rings by readers and the usage of these data by researchers (for instance www.cr-birding.org, and www.geese.org).

6.5 Enhancement of environmental monitoring

6.5.1 Collection of environmental data during counts

- Collection of data about pressures and conservation actions, following IBA methodology (BirdLife International 2006), will be encouraged at coastal sites along the East Atlantic flyway.

- This enhancement will be achieved through improved coordination (especially in countries without national BirdLife partner), easier flow of

data, more comprehensive analyses of results and regular feedback to participants.

6.5.2 Using of data from other monitoring programs

- Monitoring of factors such as hydrology, weather, habitat, benthos and fish are highly relevant to waterbird conservation and could be used as a source of explanatory variables which should be included in integrated analyses of monitoring data. The TMAP programme and the WaLTER project are already working on an overview and integration of this data for the Wadden seaitself. It will be important to select a few parameters for which it is suitable to have data for all sites along the flyway as well.

6.6 Enhancement of integration and communication

6.6.1 Data ownership and sharing

- A basic principle of this framework and programme is that it is participatory. This means that data are held and owned by the organizations and individuals that collect them. Data (counts, environmental conditions, pressures) from sites are used at national level and national results feed up further to the regional and flyway levels, coordinated by internationally organisations. Data on vital rates will mainly be collected for different species by organizations concentrating on these species and populations. In general, observers participate in the monitoring for their own benefit and submit their data for national and international analysis.
- Good feedback of results to all participants is essential to the success of participatory monitoring.

6.6.2 Communication of results and knowledge

- The principal platform for all reporting and communication on the integrated monitoring along the East Atlantic Flyway will be a web portal linking the contributing organizations and making knowledge available to stakeholders. Preferably, summaries of data (e.g. population trends, annual estimates of demographic variables) and analyses should be available on this website itself, with links to websites of the various contributing countries, institutions or groups where further information is available.
- Many of the analyses conducted by contributing organizations will result in detailed scientific papers which will be published in peer-reviewed scientific journals. These should also be summarized and linked to on the reporting platform.
- Online content will also be used by a wide variety of other practitioners such as site managers, conservation NGOs, government decision makers, and international Conventions and organizations.
- It is recommended that possibilities will be investigated to make a periodical Quality Status report for the East Atlantic Flyway as is done for the International Wadden Sea.
- Accessible, appealing storylines will be needed to raise awareness of the work among the general public and less technically minded conservation professionals.

6.7 Capacity development

- Capacity development and training are needed for data collection, analysis and reporting of monitoring data.
- Most countries in the African part of the East Atlantic Flyway would benefit from further capacity development and training.
- Most European countries on the East Atlantic Flyway have the necessary capacity already but their principal need is better cooperation, communication and sharing of data and information.
- The Training material as developed under the Wings over Wetlands project (Dodman & Boere 2010) provides a valuable source of information to help with further capacity building.

6.8 Priority activities for further development of the programme

- This section gives an overview of priorities for implementation activities for the continuation and further implementation of the integrated flyway monitoring plan.

Basic implementation of flyway monitoring plan

- Form consortium of participating organizations.
- Create Website for exchange of information and publishing of results.
- Appoint a programme coordinator (contacts with steering group, secretary of the consortium, further implementation of programme, additional fundraising, communication).

Continuing and enhancing monitoring in West Africa

- Organizing annual count of selection of (sub)sites.

PHOTO Arnold Meijer / Blue Robin

Foraging Spoonbills.

- Organizing total counts each third or sixth year depending on information need
- Organize local coordination and further training. Especially also attention for the local and national use of collected data.
- Increase geographical attention to the whole Atlantic Seaboard of Africa from Morocco to South Africa.

Monitoring demographic parameters

- Enlarge the possibilities for internet based reporting of colour marked birds to facilitate the collection of resightings (for survival estimates).
- Starting age counts in non-breeding populations for appropriate populations (for reproduction monitoring).
- Stimulate Arctic monitoring through the Arctic Breeding Bird Survey (especially important for reproduction monitoring).

Outputs

- Produce a Flyway Report for the East Atlantic Flyway about the status of species and sites, threats and conservation actions in 2019/20 after the new total count.
- Contribute to the Quality Status Reports for the Wadden Sea from the perspective of Flyway developments.
- Create online availability and update of trends for flyway populations.

Further implementation

- Stimulate the international collection of non-breeding counts in NW European coastal sites from months during spring and autumn migration.
- Prepare an online atlas of movements and connectivity between sites and countries for Wadden Sea populations along the EA flyway (based on ring recoveries, colour-ring recoveries, satellite and logger information).
- Stimulate the start of monitoring of colonial waterbirds in Europe and further continuation of this in Western Africa.

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Appendices

Annex 1. *Species and populations included in this framework*

SpcCommonName	Population	Waterbird populations occuring in International important numbers in the international Wadden Sea area	Same Wadden Sea populations but only the ones largely dependent on estuarine habitats	Other coastal waterbird populations of the East Atlantic flyway overlapping largely with the same sites as used by Wadden Sea populations
Red-throated Loon	NW Europe (non-bre)	x		
Great White Pelican	W Africa			x
Great Cormorant	sinensis, N, C Europe	x	x	
Great Cormorant	lucides Coastal W Africa			x
Grey Heron	monicae			x
Western Reef Heron	Coastal W. Africa			x
Eurasian Spoonbill	leucorodia, E Atlantic	x	x	
Eurasian Spoonbill	balsaci			x
Greater Flamingo	roseus W Africa			x
Lesser Flamingo	W Africa			x
Tundra Swan	bewickii, NW Europe (non-bre)	x		
Bean Goose	rossicus	x		
Pink-footed Goose	Svalbard (bre)	x		
Greater White-fronted Goose	albifrons, Baltic - North Sea	x		
Greylag Goose	anser, NW Europe (bre)	x		
Barnacle Goose	N Russia, E Baltic (bre)	x	x	
Brent Goose	bernicla	x	x	
Brent Goose	hrota, Svalbard (bre)	x	x	
Common Shelduck	NW Europe (bre)	x	x	
Eurasian Wigeon	NW Europe (non-bre)	x	x	
Gadwall	strepera, NW Europe (bre)	x		
Common Teal	crecca, NW Europe (non-bre)	x		
Mallard	platyrhynchos, NW Europe (non-bre)	x		
Northern Pintail	NW Europe (non-bre)	x	x	
Northern Shoveler	NW & C Europe (non-bre)	x		
Greater Scaup	marila, W Europe (non-bre)	x		
Common Eider	mollissima, Baltic, Wadden Sea	x	x	
Common Scoter	nigra	x		
Red-breasted Merganser	NW & C Europe (non-bre)	x		
African Oystercatcher	morquini			x
Eurasian Oystercatcher	ostralegus	x	x	
Pied Avocet	W Europe (bre)	x	x	
Northern Lapwing	Europe (bre)	x		
Eurasian Golden Plover	apricaria	x		
Eurasian Golden Plover	altifrons, N Europe, extreme W Siberia (bre)	x		
Grey Plover	squatarola, E Atlantic (non-bre)	x	x	
Common Ringed Plover	hiaticula	x	x	
Common Ringed Plover	psammodroma	x	x	
Common Ringed Plover	tundrae	x	x	
White-fronted Plover	mechowi Coast Angola to Cameroon			x
White-fronted Plover	arenaceus SW Africa			x
White-fronted Plover	marginatus			x
Kentish Plover	alexandrinus, E Atlantic, W Mediterranean	x	x	
Black-tailed Godwit	limosa, W Europe (bre)	x		
Black-tailed Godwit	islandica	x		x
Bar-tailed Godwit	lapponica	x	x	
Bar-tailed Godwit	taymyrensis, W, SW Africa (non-bre)	x	x	
Whimbrel	phaeopus, NE Europe (bre)	x	x	
Whimbrel	islandicus			x
Eurasian Curlew	arquata	x	x	
Spotted Redshank	Europe (bre)	x	x	
Common Redshank	totanus Northern Europe (breeding)	x	x	
Common Redshank	robusta	x	x	
Common Redshank	britannica	x	x	
Common Greenshank	NW Europe (bre)	x	x	
Ruddy Turnstone	interpres, NE Canada, Greenland (bre)	x	x	
Ruddy Turnstone	interpres, Fennoscandia, NW Russia (bre)	x	x	
Red Knot	canutus	x	x	
Red Knot	islandica	x	x	
Sanderling	E Atlantic (non-bre)	x	x	
Little Stint	Europe & West Africa (non-bre)			x
Curlew Sandpiper	W Africa (non-bre)	x	x	
Dunlin	alpina	x	x	
Dunlin	schinzii, Iceland (bre)			x
Dunlin	schinzii, Baltic (bre)	x	x	
Dunlin	schinzii, Britain & Ireland (bre)			x
Dunlin	arctica			x
Ruff	W Africa (non-bre)	x		
Common Gull	canus	x	x	
Great Black-backed Gull	NW Atlantic	x		
Herring Gull	argentatus	x	x	
Herring Gull	argenteus	x	x	
Lesser Black-backed Gull	graellsii	x		
Grey-headed Gull	poiocephalus			x
Black-headed Gull	West & Central Europe (bre)	x	x	
Slender-billed Gull	West Africa			x
Little Gull	N, C & E Europe (bre)	x		
Gull-billed Tern	nilotica, W. Europa & W. Africa (br)			x
Caspian Tern	W. Africa (br)			x
Sandwich Tern	sandvicensis, W Europe (bre)	x	x	
Royal Tern	albididorsalis			x
Roseate Tern	dougalli, W Europe (bre)			x
Common Tern	hirundo, S, W Europe (bre)	x	x	
Common Tern	hirundo, N, E Europe (bre)			x
Arctic Tern	N Eurasia (bre)	x		
Little Tern	albifrons, W Europe (bre)	x	x	
Little Tern	guineae			x
Damara Tern				x
Black Tern	niger	x		
African Skimmer	West & Central Africa			x
number of populations		64	40	27

Annex 2. *Countries included in the coastal East Atlantic Flyway. Indicated are the number of Wadden Sea relevant populations breeding or wintering per country.*

Country	Breeding
Sweden	36
Russia	34
Norway	32
Finland	27
Germany	24
Netherlands	23
Denmark	22
Estonia	21
United Kingdom	21
France	15
Belgium	14
Iceland	14
Ireland	13
Poland	9
Latvia	8
Greenland	7
Lithuania	7
Spain	7
Portugal	5
Canada	4
Svalbard	4
Italy	2
Algeria	1
Mauritania	1
Morocco	1
Senegal	1
Tunisia	1
Benin	0
Gabon	0
Gambia	0
Ghana	0
Cameroon	0
Guinea	0
Guinea-Bissau	0
Angola	0
Namibia	0
Sierra Leone	0
Ivory Coast	0
South Africa	0
Nigeria	0
Togo	0

Country	wintering
France	36
Netherlands	33
Germany	32
United Kingdom	31
Denmark	29
Ireland	26
Spain	26
Belgium	22
Mauritania	22
Portugal	19
Morocco	18
Senegal	14
Gambia	13
Guinea-Bissau	13
Sweden	12
Tunisia	12
Guinea	10
Italy	10
Ghana	9
Sierra Leone	9
Ivory Coast	7
South Africa	7
Algeria	6
Namibia	6
Norway	6
Angola	5
Latvia	5
Poland	5
Nigeria	4
Cameroon	4
Gabon	4
Estonia	3
Finland	2
Lithuania	2
Benin	1
Iceland	1
Russia	1
Togo	1
Canada	0
Greenland	0
Svalbard	0