10th Meeting of the Conference of the Parties to the Convention on Wetlands (Ramsar, Iran, 1971)

"Healthy wetlands, healthy people"

Changwon, Republic of Korea,
28 October-4 November 2008

Resolution X.21

Guidance on responding to the continued spread of highly pathogenic avian influenza

1. CONSCIOUS of the spread of highly pathogenic avian influenza (HPAI) subtype H5N1 across Eurasia and into Africa, the implications of this disease on livelihoods and human health, and the direct and indirect implications for the conservation of waterbirds and their wetland habitats (including Ramsar sites and other protected wetlands);

2. UNDERSTANDING that this virus evolved in and spread within domestic poultry but with subsequent introductions to wild bird populations, and that control of this disease within the poultry sector will reduce risks to wild waterbirds and wetlands in some situations;

3. CONCERNED that as a result of lack of understanding of the role of waterbirds and wetlands in the epidemiology of HPAI H5N1 some negative attitudes towards waterbirds and wetlands have developed with subsequent conservation and management implications, such as inappropriate closure of wetland sites (including Ramsar sites and other protected wetlands);

4. VERY CONCERNED at actual or proposed instances of the destruction of waterbirds, their nests, and their wetland habitats, as both misguided and ineffective responses to the spread of HPAI H5N1 which, as stressed by Resolution IX.23 (2005) on *Highly pathogenic avian influenza and its consequences for wetland and waterbird conservation and wise use*, do not amount to wise use;

5. RECOGNIZING that issues related to HPAI H5N1 outbreaks affect many sectors and that in order to reduce risks and maximise the effectiveness of responses, fully integrated actions are required at both national and international levels. Common visions, engagement and coordination among stakeholders, including effective coordination within governments, is critical and requires close cooperation among Multilateral Environment Agreements (MEAs) and other relevant international and national organizations;

6. COGNIZANT that the implementation of response strategies for HPAI H5N1 will involve various approaches according to particular national situations, international obligations, and the extent of disease prevalence;

7. NOTING continuing deficiencies in scientific knowledge concerning the role that some wild bird species play in the transmission and spread of HPAI H5N1 and the important need to undertake and report epidemiological investigations following cases where HPAI H5N1 infection is found in wild birds – whether apparently associated with outbreaks in poultry or not – in order to learn from these and reduce future risks;

8. CONSCIOUS that capacity development and training are essential to all responses to this and other emerging infectious diseases, and will benefit other aspects of wetland conservation, but that in many countries this remains a major issue requiring attention, especially within the veterinary sector;

9. AWARE that the long-term success of disease control measures depends on developing better public awareness and education, especially among stakeholders such as poultry keepers, the media, the public health sector, the public, wetland site managers and those within government;

10. RECALLING the conclusions and recommendations arising from the second technical meeting of the Scientific Task Force on Avian Influenza and Wild Birds (2007)[1], which reviewed recent case studies, experiences and practical 'lessons learned' in responding to outbreaks of HPAI H5N1; and

11. RECALLING the request to the STRP from the 9th meeting of the Conference of the Contracting Parties (COP9) in Resolution IX.23 to develop practical advice to assist countries in responding to this serious and rapidly developing situation, and to report on this to COP10;

THE CONFERENCE OF THE CONTRACTING PARTIES

12. STRONGLY REAFFIRMS the conclusion of Resolution IX.23 that attempts to eliminate HPAI in wild bird populations through lethal responses such as culling are not feasible and may exacerbate the problem by causing further dispersion of infected birds and that destruction or substantive modification of wetland habitats and waterbird nest sites in order to reduce contact between wild birds and humans and their domestic birds does not amount to wise use as urged by Article 3.1 of the Convention; and STRESSES that surveillance should be undertaken within the context of normal legal regulations regarding wildlife and should have minimal impact on threatened and other populations concerned;

13. ENCOURAGES all stakeholders to plan and test response strategies at various spatial scales, including national, subnational, and site scales according to level of risk, and where possible to collect and incorporate lessons learned from associated habitat management responses, and to conduct this planning at times of low risk prior to disease outbreak situations;

14. STRONGLY ENCOURAGES Contracting Parties and other governments to establish emergency response measures that involve those with relevant scientific expertise including specialist ornithologists and ensure the provision of timely advice to governments on the gathering, use, and interpretation of relevant data and information in developing risk assessments, wild bird surveillance strategies and programmes, appropriate response

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1 Available at http://www.aiweb.info/document.aspx?DocID=334

strategies, and the implementation of epidemiological investigations in the event of outbreaks of HPAI, so that these responses are made on the basis of best available information, and that wild birds are not automatically assumed to be the sources of infection;

15. URGES relevant national and international organizations to work with Contracting Parties to further develop and exchange information for decision makers, since the collection and synthesis of data and information on waterbirds and wetlands (such as the preparation and use of wetland inventories; information on the distribution, abundance and movements of birds; and the movements of poultry and poultry products) is a critical part of preparing risk assessments at various scales, as well as a part of essential contingency planning;

16. STRESSES the need for surveillance programmes in poultry to follow international scientific guidance as described in the World Organization for Animal Health (OIE) Terrestrial Animal Health Code, and in wild birds as described by the UN Food and Agriculture Organization (FAO), and also using initiatives such as the Global Avian Influenza Network for Wild Bird Surveillance (GAINS) to ensure that high quality data can inform successful epidemiological investigations;

17. URGES Contracting Parties and other governments and relevant international organizations to cooperate internationally in research programmes, surveillance, risk assessments, training in the epidemiology of wildlife diseases, exchange and sharing of relevant data and information, and collection of samples from surveillance programmes especially at times of heightened risk;

18. EMPHASISES the need for improving capacity for surveillance and response strategies where such capacity is not adequate, understanding that structures and capability for effective avian influenza control may aid control of future disease issues that affect wetland biodiversity, viability and livelihoods;

19. ADVOCATES the development of integrated communication programmes aimed at promoting balanced understanding and awareness of actual risks and appropriate responses in a range of stakeholder groups, including poultry keepers, to reduce risks to human health and increase early disease diagnosis; the public health sector, the public and media, to improve accuracy and availability of messages so as to reduce inappropriate responses; the public, to aid in public reporting for surveillance programmes; and wetland site managers, to improve contingency planning;

20. WELCOMES the broad consensus on approaches and responses developed between UN agencies, international conventions, and other international organizations; accordingly STRONGLY ENCOURAGES the continuing work, resources permitting, of the Scientific Task Force on Avian Influenza and Wild Birds to keep this developing situation under review especially as regards wetlands; identify issues for which relevant guidance is lacking (such as for example, appropriate management responses when infection is confirmed on wetlands); and particularly, to collate and synthesise further 'lessons learned' from past and current outbreaks with regard *inter alia*, to contingency planning and response strategies; and REQUESTS the continued participation in the work of the Task Force by the Convention working through the STRP and the Secretariat;

21. REQUESTS the STRP to determine whether lessons learned from responses to HPAI H5N1 have implications for Ramsar guidance relating to wetlands and their wise use, and to suggest that any such resulting modifications to guidance be submitted to the Standing Committee for consideration at COP11; and FURTHER REQUESTS the STRP in collaboration with other relevant organizations to consider how best to develop practical guidance on the prevention and control of other diseases of either domestic or wild animals in wetlands, especially those diseases that have implications for human health, and how such guidance can be best incorporated into management plans at Ramsar sites and other wetlands; and

22. ADOPTS the guidance annexed to this Resolution on responding to the issues raised by the spread of HPAI H5N1; URGES Contracting Parties and other governments to implement this guidance and further disseminate it to other interested parties (including its translation into local languages); and FURTHER REQUESTS the Secretariat and STRP to assist, with relevant international agencies and the Scientific Task Force on Avian Influenza and Wild Birds, in continuing to develop guidance that will assist countries effectively to respond to the spread and re-emergence of HPAI H5N1, and to report progress to the Standing Committee and COP11.

Annex

Guidance on responding to the continued spread of highly pathogenic avian influenza

Contents

Introduction and mandate

1. Disease can have significant impacts on wildlife populations and is of special concern for species of conservation importance that have small populations and/or are highly localised at some stages of their life cycle. Many wildlife diseases are zoonotic, that is, they can infect not only wild and domestic animals, but also have the capacity to infect humans.

2. Highly pathogenic avian influenza H5N1 of Asian lineage (HPAI H5N1) is a viral zoonotic disease that emerged in poultry in southeast Asia between 1997 and 2003. It has since attracted widespread media attention and the attention of decision-makers within governments and international agencies. Between 2003 and 2008, the virus spread in an unprecedented fashion across Asia, the Middle East, Africa and Europe. The disease has had major impacts on rural livelihoods linked to the keeping of domestic birds (mainly chickens, ducks, turkeys, ostrich and quail) and nature conservation, including mortality of waterbirds at many Ramsar sites and negative public attitude toward waterbirds and their habitats as a result of lack of understanding of the role of wild birds in the epidemiology of the disease. There have also been major concerns as to the potential for viral change that might precipitate a human influenza pandemic, given the ongoing exposure of humans to the circulating avian virus through close contact with infected domestic birds and their products.

3. The total number of wild birds known to have been affected has been small in contrast to the number of domestic birds affected. Perhaps a greater threat than direct mortality has been the development of public fear about waterbirds resulting in misguided attempts to control the disease by disturbing or destroying wild birds and their habitats, inappropriate closure of some wetland sites and other outcomes detrimental to nature conservation. Such responses have often been encouraged by misleading and exaggerated messages in the media.

4. Addressing issues raised by the spread of HPAI H5N1 offers an important opportunity to promote effective structures and policies that can also provide models for the control of other emergent diseases. This is an important objective since wildlife disease is increasingly being recognized as a central issue for conservation managers. This is in addition to the disease's very significant impact on domestic animals and human health.

5. The UN Food and Agriculture Organization (FAO) and the World Organization for Animal Health (OIE) are leading efforts to control avian influenza within the agricultural sector (poultry industry), whilst preparedness for a potential influenza pandemic, and control and prevention of human zoonotic disease, are the responsibilities of the World Health Organization (WHO).

6. Ramsar's 9th meeting of the Conference of the Contracting Parties (COP9) in 2005 recognized that, as well as the direct impacts of HPAI H5N1 on susceptible birds, public attitudes (and therefore support for wetland conservation, particularly of Ramsar sites and other wetlands of importance for waterbirds) could be negatively affected by concerns about the possible role of waterbirds in the spread of HPAI H5N1. Parties at COP9 were also greatly concerned that in many countries there was a significant lack of information and, in some countries, public misunderstanding, about important issues related to the spread of HPAI, the risks it may pose, and how to anticipate and respond to outbreaks of HPAI. Accordingly COP9 agreed Resolution IX.23 on *Highly pathogenic avian influenza and its*

consequences for wetland and waterbird conservation and wise use. This Resolution *inter alia* called on the Convention's Scientific and Technical Review Panel (STRP) to develop practical advice that could assist countries in responding to this serious and rapidly developing situation.

7. In particular, Ramsar COP9 requested the STRP, with the Scientific Task Force on Avian Influenza and Wild Birds, to provide relevant input on practical measures to reduce the risk of disease transmission between wild, captive and domestic birds to those agencies developing contingency and wetland management plans related to HPAI H5N1; to share this information, including practical advice that will assist countries to respond to this serious and rapidly developing situation; and to report to COP10.

8. In response, the STRP has developed guidance for consideration by the Convention's Standing Committee and Contracting Parties at COP10. The advice comes in four main sections:

   Section 1. A 'guide to avian influenza guidance';
   Section 2. Guidelines for reducing avian influenza risks at Ramsar sites and other wetlands;
   Section 3. Recommended ornithological information to be collected during surveillance programmes or field assessment; and
   Section 4. Guidelines for Ornithological Expert Panels.

9. The policy positions and technical guidance of the main international conventions and environment agreements concerned with the conservation of wild birds, such as the Convention on Biological Diversity (CBD), Convention on Migratory Species (CMS), and the Ramsar Convention, have been set out in Resolutions agreed and adopted at their respective Conferences of Contracting Parties (see Section 1.3). In addition, the Scientific Task Force on Avian Influenza and Wild Birds (Appendix 2) established by CMS and now co-convened with FAO, is coordinating international scientific advice, including advice on the conservation impact of avian influenza. The Task Force website provides access to a wide range of resources on avian influenza, wildlife, and the environment and is accessible at www.aiweb.info.

10. Regrettably, since November 2005, there has been further spread of this virus westwards through Eurasia and into Africa[2]. As a consequence, further experience since Ramsar COP9 in 2005 has been gained with respect to the establishment of surveillance systems for the virus and responding to cases of infection. Important lessons include:

    - That there is a need for risk assessment and response processes at various scales, including the preparation and implementation of cross-sectoral national contingency plans involving all relevant parts of government. Such planning is central to preparing and responding to HPAI outbreaks, and should be undertaken, wherever possible, before disease occurs.

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[2] Kilpatrick, M., Chmura, A.A., Gibbons, D.W., Fleischer, R.C., Marra, P.P. & Daszak, P. 2006. Predicting the global spread of H5N1 avian influenza. *Proceedings of the National Academy of Sciences* 103(15): 19368–19373. http://www.pnas.org/cgi/reprint/103/51/19368; and

Sabirovic, M., Wilesmith, J., Hall, S., Coulson, N., Landeg, F. 2006. Situation Analysis – Outbreaks of HPAI H5N1 virus in Europe during 2005/2006 – An overview and commentary. DEFRA, International Animal Health Division, United Kingdom. 40 pp. http://www.defra.gov.uk/animalh/diseases/monitoring/pdf/hpai-europe300606.pdf

- That the development and implementation of surveillance and early warning systems valuably inform responses. These schemes should be developed on the basis of best practice international guidance, be informed by risk assessments, be undertaken to the highest standards – including validation and quality assurance of data – and be implemented using strategic approaches at regional or wider scales.

- That accurate identification of wild birds, either captured as part of surveillance programmes or reported from infection outbreaks, is critical to understanding the epidemiology of the disease and thus the processes of risk assessment.

- That whilst there is now a wide range of guidance on issues concerning HPAI H5N1, this exists mostly in just a few international languages, and there is an important need to ensure that key elements are made more widely available to stakeholders and translated into other languages.

- That there has been a welcome increase in the amount of surveillance, including the development of national and regional early warning systems. The development of the Global Avian Influenza Network for Surveillance (GAINS: www.gains.org) has been a very positive development, which has facilitated the sharing of relevant data and information at international scales. Yet the quality of much ornithological information from AI surveillance programmes is often poor, especially with regard to the precise identification of bird species. As recommended by the Scientific Task Force on Avian Influenza and Wild Birds, the involvement of ornithologists in these programmes would help resolve these issues.

- That, as well as traditional marking methods, i.e., ringing/banding, new methodologies such as satellite telemetry have the potential to provide information on the movements of wild birds, especially at flyway scales, and thus can better inform risk assessments.

- That there remains a need for further analysis of ornithological datasets and research on a range of issues related to the role of waterbirds in the epidemiology of the disease, as well as a better understanding of the details of the formal and informal trade in poultry.

1) Guidance related to preparing for and responding to outbreaks of highly pathogenic avian influenza, especially at wetlands

1.1) Introduction

11. Ramsar COP9 requested the Scientific and Technical Review Panel (STRP), with the Scientific Task Force on Avian Influenza and Wild Birds, to provide relevant input on practical measures to reduce the risk of disease transmission between wild, captive and domestic birds to those agencies developing contingency and wetland management plans related to HPAI H5N1; to share this information, including practical advice that will assist countries in responding to this serious and rapidly developing situation; and to report to COP10.

12. Since COP9, a large body of guidance on responding to the challenges of the spread of HPAI H5N1 has been produced, including much material made available through FAO and OIE websites (see Section 1.3). This includes guidance related to surveillance, enhanced biosecurity, contingency planning and preparation, and responses to outbreaks of HPAI infection.

13. Presented here is a 'guide to guidance', a guide to the significant body of information that has been published (mostly since 2005) and which is of potential utility to Ramsar Contracting Parties and others governments and organizations.

14. The guide consists of a guidance framework (Section 1.2), which provides a conceptual map of the available guidance, and a directory of guidance materials (Section 1.3), which organizes the guidance under a number of separate issues and provides source information and hyperlinks.

1.2) A guidance framework

15. Responding to avian influenza – to the perceived threat as well as to outbreaks of disease – involves a wide range of activities from writing contingency plans to sampling wild birds to dealing with the media. Additional complexity is added by the varying scale on which these activities must be completed – for example, contingency plans are required at the international, national, subnational and site levels.

16. These activities are summarised in Table 1, which provides a 'road-map' not only to the activities required at different levels of risk but also to the guidance that exists for these activities.

17. The levels of risk are defined as follows:

- **Low risk** - no known infection in geographical region
- **Medium risk** - spreading infection in wild birds or poultry in region
- **High risk** - infection in neighbouring countries/regions
- **Immediate risk** - infection in a country/region affecting either wild birds or poultry
- **Post infection** - period following an incursion of HPAI

18. The required activities and available guidance are also categorised under seven separate themes:

    - Expert advice and integration within government;
    - Risk assessment;
    - Contingency planning;
    - Surveillance and early warning (wild birds);
    - Epidemiological investigations (response and reporting);
    - Communication, education and public awareness, including media handling; and
    - Guidance for other stakeholders, including relevant statutory bodies.

19. For each theme (for example, contingency planning) and at each level of risk (above), Table 1 provides an introduction to the main activities that should be considered and the principle sources of guidance that are available. **Note, however, that this table does not provide a definitive summary of legal obligations under the auspices of other relevant international organizations.**

20. A further – cross-cutting – theme of capacity development is of very great importance and underpins the ability to respond in all themes and at all risk stages. Relevant guidance on capacity development is separately highlighted in Table 1.

Table 1. A conceptual map of response activities and the corresponding guidance available. Numbers relate to specific guidance listed in Section 1.3.

MAJOR THEMES

Risk level	Expert advice & integration within government	Risk assessment	Contingency planning	Surveillance & early-warning (wild birds)	Epidemiological investigations (response & reporting)	Communication (CEPA) & media issues	Other stakeholders inc. relevant statutory bodies
Low risk No known infection in geographical region	Identify relevant multi-disciplinary expertise [21]. Establish an Ornithological Expert Panel (OEP – see Section 4) processes & arrangements [12]. Identify OEP links with neighbouring countries. Develop information tools to assist decision making [06, 17, 18].	As part of the development of a contingency plan, establish arrangements for developing risk assessments. Undertake risk assessment in discussion with Ornithological Expert Panel (OEP – Section 4 [01, 02, 14, 20, 41]. Develop information tools to assist decision making [06, 17, 18].	Develop contingency plan for appropriate area, including wetland sites [42, 14, 15, 16, 20], captive collections [44, 45, 54]) in consultation with stakeholders and experts [08, 09, 10, 41]. Collaboration with neighbouring countries. Ensure contingency plans are in line with relevant international and national obligations, *inter alia*, for nature conservation and animal health [21].	Develop national strategy [25, 39, 319, 369], including: - Determining lists of potentially higher risk species [01, 03, 06, 18] and areas [06] - Consultation - International co-ordination. Determine and address capacity development needs. Implement strategy with appropriate methodology [65, 61, 66, 67, 64, 69, 68]. Ensure provision of data to GAINS [64] and/or other reporting hub(s) [62, 63].	Identify relevant multi-disciplinary expertise [21]. Establish arrangements with multi-disciplinary epidemiological teams. Establish protocols [55, 38, 41, 43].	Establish media strategy in context of the national contingency plan [08, 09, 75-80]. Develop media tool kit [78, 79, 80] – including frequently asked questions, maps, positive stories, images, etc. Publish relevant explanatory materials/statement on appropriate web-sites. Identify organizational spokespeople and appropriately train them [75-80].	Develop and maintain contact networks with appropriate stakeholders and establish communication procedures. Establish dialogue regarding best practice biosecurity [26]. Disseminate best practice health & safety guidance to relevant stakeholders [59, 55, 56, 57, 73 58].

Risk level	Expert advice & integration within government	Risk assessment	Contingency planning	Surveillance & early-warning (wild birds)	Epidemiological investigations (response & reporting)	Communication (CEPA) & media issues	Other stakeholders inc. relevant statutory bodies
Medium risk Spreading infection in wild birds or poultry in region	Undertake risk assessment in discussion with OEP.	Update risk assessment in discussion with OEP and neighbouring countries/regions.	Implement appropriate processes of contingency plans.	OEP to consider need for enhanced surveillance.		Update media tool kit and explanatory materials [78, 79, 80]. Consider briefing appropriate media on relevant issues.	Review and update contact network. Brief appropriate stakeholders via a contact network. Advise on relevant and necessary responses [26].
High risk Infection in neighbouring countries/ regions	Convene OEP. Update risk assessment. Exchange risk assessment with neighbouring countries/regions.	Update risk assessment in discussion with OEP and neighbouring countries/regions.	Implement appropriate processes of contingency plans.	OEP to consider need for enhanced surveillance.	Ensure preparedness of epidemiological investigation teams and wider contingency planning issues in the event of an outbreak.	Update media tool kit and explanatory materials [78, 79, 80]. Brief appropriate media on the issues. Implement media strategy.	Review and update contact network. Brief appropriate stakeholders via a contact network. Advise on relevant and necessary responses [26].
Immediate risk Active infection in a country affecting either wild birds or poultry	Convene OEP. Use expert advice to guide epidemiological investigations. Use expert advice to guide local responses at the infected premise(s). Use expert advice to determine surveillance needs.	Update risk assessment in discussion with OEP and neighbouring countries/regions. Undertake formal reporting to OIE as appropriate.	Implement appropriate processes of contingency plans.	OEP to consider need for enhanced surveillance especially around infected premises and including potential bridge species.	Undertake epidemiological investigations around infected premise(s) involving relevant expertise. Communicate epidemiological findings with linked countries/regions. Publish results including negative results.	Update media tool kit and explanatory materials [78, 79, 80]. Undertake regular briefings of appropriate media on relevant issues. Implement media strategy.	Review and update contact network.. Undertake regular briefings of appropriate stakeholders via contact network. Advise on relevant and necessary responses [26].

Risk level	Expert advice & integration within government	Risk assessment	Contingency planning	Surveillance & early-warning (wild birds)	Epidemiological investigations (response & reporting)	Communication (CEPA) & media issues	Other stakeholders inc. relevant statutory bodies
Post infection (Period following an incursion of HPAI)	Review and update OEP procedures in light of lessons learnt [e.g. 27].	Review and update risk assessment procedures in light of lessons learnt.	Review and update contingency plans in light of lessons learnt.	Review list of potentially higher risk species and areas. Review and update surveillance strategy in light of lessons learnt.	Review and update epidemiological investigation strategy in light of lessons learnt.	Review and update media strategy in light of lessons learnt.	Review and update communication arrangements in light of lessons learnt.

CROSS-CUTTING ISSUES

(Relevant at all risk levels)	Risk assessment	Contingency planning	Expert advice & integration within government	Surveillance & early-warning (wild birds)	Epidemiological investigations (response & reporting)	Communication (CEPA) & media issues	Other stakeholders inc. relevant statutory bodies
Capacity development	Develop information tools to assist decision making.	Ensure capacity development in addressed is contingency planning.	Develop information tools to assist decision making.	Determine capacity dev needs and address shortcomings.	Ensure adequate capacity to undertake investigations.	Training of spokespeople.	

1.3) A directory of good practice guidance concerning highly pathogenic avian influenza H5N1

21. This directory aims to provide an introduction to the increasingly large number of technical and other guidances that have been produced in recent years related to issues arising from the spread of HPAI H5N1.

22. The directory provides hyperlinks to publications that are accessible via the Internet, and it has also attempted to categorise such guidance with respect to its intended audience and its technical level (i.e., accessibility to various groups within society) and to indicate the language(s) available. The current listing is dominated by publications in the English language. It is hoped that future versions of this listing will contain a better representation of publications in other languages. Contracting Parties and others are encouraged to submit further examples of good practice guidance to Ramsar's STRP so that this listing can be continually updated.

Important note: The Ramsar Convention does not necessarily endorse any of the content of the external web links listed here. These are given solely in the context of their possible utility to Contracting Parties and others.

23. **Levels of accessibility** are roughly assessed as follows:

Public	Content accessible to untrained public
General	Content accessible to informed public, other stakeholder groups and interested parties, as well as trained professionals
Technical	Language and content aimed largely at professionals or technical specialists in the subject area concerned

Structure and content

24. Guidance documents are organized under the following topics and subtopics:

- **Contingency planning and risk assessment**
  - Background
  - General
  - Nature reserves and wild birds
- **Prevention and control**
  - Background
  - General
  - Nature reserves and wild birds
  - Captive collections
  - Poultry holdings
  - Vaccination
  - Health & Safety
- **Surveillance and early warning systems**
  - General
  - Methodology
  - Past initiatives
  - Health & Safety
- **Communication, education and public awareness (CEPA)**
  - General

Table 2. Directory of guidance materials related to avian influenza.

	AUDIENCE	LEVEL
CONTINGENCY PLANNING AND RISK ASSESSMENT		
BACKGROUND		
European Food Safety Authority (EFSA) 01 **Opinion of EFSA panel on animal health and welfare and their scientific report on migratory birds and their possible role in the spread of highly pathogenic avian influenza** English: http://www.efsa.europa.eu/en/science/ahaw/ahaw_opinions/1484.html	Policy makers & scientists	Technical
02 **Opinion adopted by the AHAW Panel related to Animal health and welfare risks associated with the import of wild birds other than poultry into the European Union** English: http://www.efsa.europa.eu/en/science/ahaw/ahaw_opinions/ahaw_op_ej410_captive_birds.html	Policy makers & scientists	Technical
USGS National Wildlife Health Center (NWHC) 03 **List of Species Affected by H5N1 (Avian Influenza)** English: http://www.nwhc.usgs.gov/disease_information/avian_influenza/affected_species_chart.jsp	Policy makers & scientists	General
Centers for Disease Control and Prevention (CDC) 04 **Wildlife Trade and Global Disease Emergence** English: http://www.cdc.gov/ncidod/EID/vol11no07/05-0194.htm	Policy makers & scientists	General
Department for Environment, Food and Rural Affairs (United Kingdom) 05 **Outbreaks of H5N1 HPAI virus in Europe during 2005/2006: an overview and commentary** English: http://www.defra.gov.uk/animalh/diseases/monitoring/pdf/hpai-europe300606.pdf	Policy makers & scientists	General
British Trust for Ornithology 06 **Avian Influenza Incursion Analysis (through wild birds)** English: http://www.bto.org/research/reports/Avian_flu.pdf	Policy makers & scientists	Technical
European Commission 07 **National websites of EU Member States dealing with H5N1** Various EU languages: http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/nat_websites_en.htm	Policy makers & poultry sector	General
GENERAL		
Food and Agriculture Organization (FAO) 08 **Manual on the preparation of national animal disease emergency preparedness plans** English: http://www.fao.org/DOCREP/004/X2096E/X2096E00.HTM	Policy makers & veterinary professionals	Technical
09 **National contingency and avian/human pandemic influenza preparedness plans** Various languages: http://www.fao.org/avianflu/en/strategydocs.html	Policy makers	General
10 **Preparing for highly pathogenic avian influenza: a manual for countries at risk** English: http://www.fao.org/docs/eims/upload/200354/HPAI_manual.pdf	Policy makers & poultry sector	General
World Organization for Animal Health (OIE) 11 **Terrestrial Animal Health Code** English: http://www.oie.int/eng/Normes/mcode/en_sommaire.htm	Policy makers, poultry sector & veterinary	General

http://www.oie.int/eng/normes/mcode/en_titre_1.3.htm (Section 1.3: Risk Analysis) http://www.oie.int/eng/normes/mcode/en_chapitre_2.7.12.htm (Section 2.7.12: Avian Influenza)	professionals	
Ramsar Convention on Wetlands 12 **Ornithological Expert Panels** English: Section 4 of this Annex (Annex to Ramsar Resolution X.10) French: Section 4 of this Annex (Annex to Ramsar Resolution X.10) Spanish: Section 4 of this Annex (Annex to Ramsar Resolution X.10)	Policy makers	General
NATURE RESERVES AND WILD BIRDS		
Ramsar Convention on Wetlands 13 **Handbook 11: Inventory, assessment and monitoring** English: http://ramsar.org/lib/lib_handbooks2006_e11.pdf French: http://ramsar.org/lib/lib_handbooks2006_f11.pdf (Manuel 11: Inventaire, évaluation et suiv) Spanish: http://ramsar.org/lib/lib_handbooks2006_s11.pdf (Manual 11: Inventario, evaluación y monitoreo)	Site managers	General
14 **Wetland Risk Assessment Framework** English: http://www.ramsar.org/key_guide_risk_e.htm French: http://www.ramsar.org/key_guide_risk_f.htm (Cadre d'évaluation des risques pour les zones humides) Spanish: http://www.ramsar.org/key_guide_risk_s.htm (Marco para evaluar el riesgo en humedales)	Policy makers & site managers	General
15 **The Ramsar 'Toolkit'** English: http://www.ramsar.org/lib/lib_handbooks2006_e.htm French: http://www.ramsar.org/lib/lib_handbooks2006_f.htm (La "boîte à outils" de la Convention de Ramsar) Spanish: http://www.ramsar.org/lib/lib_handbooks2006_s.htm ("Juego de herramientas" de la Convención de Ramsar)	Policy makers & site managers	General
16 **Handbook 16: Managing wetlands** English: http://ramsar.org/lib/lib_handbooks2006_e16.pdf French: http://ramsar.org/lib/lib_handbooks2006_f16.pdf (Gestion des zones humides) Spanish: http://ramsar.org/lib/lib_handbooks2006_s16.pdf (Manejo de humedales)	Site managers	General
European Commission 17 **Urgent preliminary assessment of ornithological data relevant to the spread of Avian Influenza in Europe** English: http://ec.europa.eu/environment/nature/conservation/wildbirds/birdflue/docs/rep_spread_avian_influenza_report.pdf	Policy makers & scientists	Technical
18 **Ornithological data relevant to the spread of Avian Influenza in Europe (phase II): further identification and first field assessment of Higher Risk Species** English: http://ec.europa.eu/environment/nature/conservation/wildbirds/birdflue/docs/spread_avian_influenza.pdf	Policy makers & scientists	Technical
19 **Methodology for rapid assessment of ornithological sites** English: http://ec.europa.eu/environment/nature/nature_conservation/focus_wild_birds/avian_influenza/pdf/3	Policy makers & site managers	General
Health Protection Agency / Department for Environment, Food and Rural Affairs (United Kingdom) 20 **Risk assessment: avian influenza in public parks/parkland & open waters due to wild bird exposure** English: http://www.hpa.org.uk/infections/topics_az/influenza/avian/documents/AIParksandOpenWatersRiskAssessment-July2006.pdf	Public, captive collection managers & site managers	General

PREVENTION AND CONTROL		
BACKGROUND		
Ramsar Convention on Wetlands 21 **Resolution IX.23. Highly pathogenic avian influenza and its consequences for wetland and waterbird conservation and wise use (8-15 Nov 2005, Kampala, Uganda)** English: http://www.ramsar.org/res/key_res_ix_23_e.htm French: http://www.ramsar.org/res/key_res_ix_23_f.htm (Résolution IX.23. L'influenza aviaire hautement pathogène et ses conséquences pour la conservation et l'utilisation rationnelle des zones humides et des oiseaux d'eau) Spanish: http://www.ramsar.org/res/key_res_ix_23_s.htm (Resolución IX.23. La gripe aviar hiperpatogénica y sus consecuencias para la conservación y el uso racional de los humedales y las aves acuáticas)	Policy makers & Ramsar administrative authorities	General
Food and Agriculture Organization (FAO) 22 **Enhancing control of highly pathogenic avian influenza in developing countries through compensation: issues and good practice** English: http://www.fao.org/docs/eims/upload//217132/gui_hpai_compensation.pdf 23 **Highly Pathogenic Avian Influenza in Africa** English: http://www.fao.org/docs/eims/upload//217651/hpai_strategy_africa_en.pdf 24 **Epidemiology of H5N1 Avian Influenza in Asia and implications for regional control** English: http://www.fao.org/ag/againfo/subjects/documents/ai/HPAI-Masseyreport.pdf 25 **FAO Regional Office for Latin America and the Caribbean** Spanish: http://www.rlc.fao.org/es/prioridades/transfron/aviar/default.htm	Policy makers & poultry sector Policy makers Policy makers & poultry sector Policy makers & poultry sector	General General Technical General
SCOFCAH/ORNIS 26 **Summary Record of the Joint Standing Committee on the Food Chain and Animal Health (SCOFCAH) and of the Ornis Committee/SWG held in Brussels on 1 Dec 2006** English: http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/docs/scofcah_ornis_com_01122006_en.pdf	Policy makers	General
Avian Diseases (journal) 27 **Lessons learned from Asian H5N1 outbreak control** (Sims, L.D. 2007. Lessons learned from Asian H5N1 outbreak control. *Avian Diseases* 50: 174-181) English: http://www.ncbi.nlm.nih.gov/sites/entrez?term=17494550&cmd=search&db=pubmed	Policy makers & scientists	Technical
GENERAL		
Emerging Infectious Diseases (journal) 28 [**Tackling a] multifocal avian influenza (H5N1) outbreak** English: http://www.cdc.gov/eid/content/13/10/1601.htm	Policy makers	General
Eurosurveillance Weekly (journal) 29 **Preventing introduction and spread of avian influenza among bird flocks in Europe: recommendations by European Animal Health Panel** English: http://www.eurosurveillance.org/ew/2005/050929.asp	Policy makers	General

Food and Agriculture Organization (FAO)		
30 **Recommendations on the Prevention, Control and Eradication of Highly Pathogenic Avian Influenza (HPAI) in Asia** English: http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/27septrecomm.pdf	Policy makers & poultry sector	General
31 **Emergency assistance for early detection and prevention of avian influenza in the Eastern Europe and Caucasus regions** English: http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/cd/documents/RAF3004d.pdf	Policy makers & poultry sector	General
32 **Emergency assistance for early detection and prevention of avian influenza in Western Africa** English: http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/cd/documents/RAF3016.pdf	Policy makers & poultry sector	General
33 **Emergency assistance for early detection and prevention of avian influenza in the Middle East region** English: http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/cd/documents/RAF3005.pdf	Policy makers & poultry sector	General
34 **Emergency assistance for early detection and prevention of avian influenza in eastern and southern Africa** English: http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/cd/documents/RAF3017.pdf	Policy makers & poultry sector	General
35 **List of FAO avian influenza manuals and training materials** Spanish: http://www.fao.org/avianflu/es/manuals_es.html	Policy makers, poultry sector & scientists	General
Wetlands International		
36 **How to stop further outbreaks** English: http://www.wetlands.org/articlemenu.aspx?id=31c525ed-c4d5-491e-83d9-120dbf3979c1	Public, policy makers & scientists	General
BirdLife International		
37 **Guidance for public authorities** English: http://www.birdlife.org/action/science/species/avian_flu/pdfs/Guidance_Public_Authorities.pdf	Public & policy makers	General
Department for Environment, Food and Rural Affairs (United Kingdom)		
38 **Summary epidemiological report on a H5N1 HPAI case in turkeys in England, January 2007 (includes modus operandi of the UK Ornithological Expert Panel (OEP))** English: http://www.defra.gov.uk/animalh/diseases/notifiable/disease/ai/pdf/epid_findings050407.pdf	Policy makers, poultry sector & scientists	General
European Commission		
39 **Council Directive 2005/94/EC of 20 December 2005 on Community measures for the control of avian influenza and repealing Directive 92/40/EEC** All EU languages: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005L0094:EN:NOT	Policy makers & poultry sector	Technical
40 **Commission Decision of 26 April 2004 approving contingency plans for the control of avian influenza and Newcastle disease (Text with EEA relevance) (notified under document number C(2004) 1517)** All EU languages: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004D0402:EN:NOT	Policy makers & poultry sector	Technical
World Organization for Animal Health (OIE)		
41 **Terrestrial Animal Health Code** English: http://www.oie.int/eng/Normes/mcode/en_sommaire.htm http://www.oie.int/eng/normes/mcode/en_chapitre_1.1.2.htm (Section 1.1.2: Notification of Diseases and Epidemiological Information to OIE) http://www.oie.int/eng/normes/mcode/en_chapitre_2.7.12.htm (Section 2.7.12: Avian Influenza)	Policy makers, poultry sector & veterinary professionals	General

NATURE RESERVES AND WILD BIRDS		
Ramsar Convention on Wetlands 42 **Guidelines for reducing avian influenza risks at Ramsar sites and other wetlands of importance to waterbirds** English: Section 2 of this Annex (Annex to Ramsar Resolution X.10) French: Section 2 of this Annex (Annex to Ramsar Resolution X.10) Spanish: Section 2 of this Annex (Annex to Ramsar Resolution X.10)	Site managers	General
43 **Recommended ornithological information to be collected during surveillance programmes or field assessment of wild bird mortality events, especially at wetlands** English: Section 3 of this Annex (Annex to Ramsar Resolution X.10) French: Section 3 of this Annex (Annex to Ramsar Resolution X.10) Spanish: Section 3 of this Annex (Annex to Ramsar Resolution X.10)	Scientists, veterinary professionals, and site managers	General
CAPTIVE COLLECTIONS (See also: VACCINATION)		
European Commission 44 **Commission Decision of 28 August 2007 concerning measures to prevent the spread of highly pathogenic avian influenza to other captive birds kept in zoos and approved bodies, institutes or centres in the Member States** All EU languages: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007D0598:EN:NOT	Policy makers & captive collection managers	Technical
British and Irish Association of Zoos and Aquariums (BIAZA) 45 **Advice from the British and Irish Association of Zoos and Aquariums on avian influenza** English: http://www.biaza.org.uk/public/pages/care/avian.asp	Captive collection managers	General
POULTRY HOLDINGS (See also: VACCINATION)		
Emerging Infectious Diseases (journal) 46 **Control of avian influenza in poultry** English: http://www.cdc.gov/ncidod/EID/vol12no09/06-0430.htm	Policy makers & poultry sector	General
Food and Agriculture Organization (FAO) 47 **Prevention and Control of Avian Flu in Small-scale Poultry: A guide for veterinary paraprofessionals** English: http://www.fao.org/ag/againfo/subjects/documents/ai/AIManual_VN2005(en).pdf French: http://www.fao.org/ag/againfo/subjects/documents/ai/AI-Manual-french.pdf Indonesian: http://www.fao.org/ag/againfo/subjects/documents/ai/AI_GuideIndonesia.pdf Kyrgystan: http://www.fao.org/ag/againfo/subjects/documents/ai/Avian_Flu_kr.pdf Lao: http://www.fao.org/ag/againfo/subjects/documents/ai/AIGuideParavets_lao_.pdf Russian: http://www.fao.org/ag/againfo/subjects/documents/ai/AI-Manual-russian.pdf Spanish: http://www.fao.org/ag/againfo/subjects/documents/ai/AI-Manual-spanish.pdf Vietnamese: http://www.fao.org/ag/againfo/subjects/documents/ai/AIManual_VN2005(vn).pdf	Poultry sector & veterinary professionals	General
48 **Prevention and Control of Avian Flu in Small-scale Poultry: A guide for veterinary paraprofessionals in Vietnam** English: http://www.fao.org/ag/againfo/subjects/documents/ai/AIManual_VN2005(en).pdf	Poultry sector & veterinary professionals	General
49 **Prevention and Control of Avian Flu in Small-scale Poultry: A guide for veterinary paraprofessionals in Cambodia** English: http://www.fao.org/ag/againfo/subjects/documents/ai/AI-paravets-guide.pdf	Poultry sector & veterinary professionals	General

VACCINATION		
PloS Medicine (journal) 50 **A comparative analysis of influenza vaccination programs** English: http://medicine.plosjournals.org/perlserv?request=get-document&doi=10.1371/journal.pmed.0030387	Policy makers, poultry sector & veterinary professionals	Technical
European Commission 51 **Vaccination of poultry against highly pathogenic avian influenza H5N1 (Diva strategy)** English: http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/discussion_paper.pdf	Policy makers, poultry sector & veterinary professionals	Technical
European Food Safety Authority (EFSA) 52 **Opinion of the Scientific Panel on Animal Health and Welfare (AHAW) related with the vaccination against avian influenza of H5 and H7 subtypes in domestic poultry and captive birds** English: http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178621165004.htm 53 **Opinion of the Scientific Panel on AHAW on a request from the Commission related with the vaccination against AI of H5 and H7 subtypes as a preventive measure carried out in Member States in birds kept in zoos under Community approved programmes** English: http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178620772568.htm	Policy makers, poultry sector & veterinary professionals Policy makers, captive collection managers & veterinary professionals	General General
British and Irish Association of Zoos and Aquariums (BIAZA) 54 **Guidelines on vaccinating birds against avian influenza** English: http://www.biaza.org.uk/resources/library/images/BIAZA QA Vaccination.pdf	Captive collection managers and veterinary professionals	Technical
HEALTH & SAFETY		
Centers for Disease Control and Prevention 55 **Interim guidance for protection of persons involved in U.S. avian influenza outbreak disease control and eradication activities** English: http://www.cdc.gov/flu/avian/professional/protect-guid.htm Spanish: http://www.cdc.gov/flu/avian/es/protectionguid_es.htm (Guía provisional para la protección de personas que participen en actividades de control y erradicación de brotes de gripe aviar (o gripe del pollo) en EE.UU.) 56 **Interim recommendations for persons with possible exposure to avian influenza during outbreaks among poultry in the United States** English: http://www.cdc.gov/flu/avian/professional/possible-exposure.htm	Poultry sector Public & poultry sector	General General
US Department of Labor Occupational Safety & Health Administration (OSHA) 57 **OSHA Guidance Update on Protecting Employees from Avian Flu (Avian Influenza) Viruses** English: http://www.osha.gov/Publications/3323-10N-2006-English-07-17-2007.html Spanish: http://www.scribd.com/doc/357117/avian-flu-guidance-spanish?ga_related_doc=1 (Orientación actualizada de OSHA acera de Cómo proteger a los empleados contra los virus de la gripe aviar (influenza aviar))	Poultry sector	General

World Health Organization (WHO) 58 **Protection of individuals with high poultry contact in areas affected by avian influenza H5N1: Consolidation of pre-existing guidance** English: http://www.who.int/csr/disease/avian_influenza/guidelines/high_contact_protection/en/index.html	Animal handlers & poultry sector	General
Food and Agriculture Organization (FAO) 59 **Avian Influenza and Human Health: Risk reduction measures in producing, marketing and living with animals in Asia** English: http://www.fao.org/ag/againfo/subjects/documents/ai/concmalaysia.pdf	Policy makers & poultry sector	General
SURVEILLANCE AND EARLY WARNING SYSTEMS		
GENERAL		
Food and Agriculture Organization (FAO) 60 **Guiding Principles for Highly Pathogenic Avian Influenza Surveillance and Diagnostic Networks in Asia** English: http://www.fao.org/docs/eims/upload//210749/Gui_principlesHPAI_july04_en.pdf	Policy makers & poultry sector	Technical
European Commission 61 **Guidelines for AI surveillance in wild birds and poultry (in 2007/268/EC: Commission Decision of 13 April 2007 on the implementation of surveillance programmes for avian influenza in poultry and wild birds to be carried out in the Member States)** EU languages: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32007D0268:EN:NOT 62 **EU Animal Disease Notification System (ADNS)** English: http://ec.europa.eu/food/animal/diseases/adns/index_en.htm	Policy makers, scientists and veterinary professionals Scientists	Technical Technical
World Organization for Animal Health (OIE) 63 **OIE World Animal Health Situation - Information System and Database** English: http://www.oie.int/eng/info/en_info.htm?e1d5	Policy makers, scientists & poultry sector	General
Global Avian Influenza Network for Surveillance (GAINS) 64 **Website for the Wild Bird Global Avian Influenza Network for Surveillance (GAINS)** English: http://www.gains.org/	Scientists & veterinary professionals	General
METHODOLOGY		
Food and Agriculture Organization (FAO) 65 **Wild bird HPAI surveillance: sample collection from healthy, sick and dead birds (AGA Manual No. 4)** English: http://www.fao.org/docs/eims/upload/218650/manual_wildbird_en.pdf French: http://www.fao.org/docrep/010/a0960f/a0960f00.htm Spanish: http://www.fao.org/docrep/010/a0960s/a0960s00.htm Chinese: http://www.fao.org/docrep/010/a0960c/a0960c00.htm Russian: http://www.fao.org/docrep/010/a0960r/a0960r00.htm 66 **Wild birds and avian influenza: an introduction to applied field research and disease sampling techniques (AGA Manual No. 5)** English: http://www.fao.org/ag/againfo/resources/en/manuals/manual5.pdf	Scientists & veterinary professionals Scientists & veterinary professionals	Technical Technical

Wetlands International 67 **Emergency assistance for early detection and prevention of avian influenza: Terms of reference for participants in field sampling missions** English: Wetlands International internal guidance – available on request	Scientists & veterinary professionals	General
Wildfowl & Wetlands Trust (WWT) 68 **WWT Wildfowl Catch Manual** English: WWT internal guidance – available on request.	Scientists & veterinary professionals	General
World Organization for Animal Health (OIE) 69 **Terrestrial Animal Health Code** English: http://www.oie.int/eng/Normes/mcode/en_sommaire.htm http://www.oie.int/eng/normes/mcode/en_chapitre_3.8.1.htm (Section 3.8.1: Guidelines for animal health surveillance) http://www.oie.int/eng/normes/mcode/en_chapitre_3.8.9.htm (Section 3.8.9: Guidelines for surveillance of avian influenza)	Poultry sector & veterinary professionals	General
PAST INITIATIVES		
Wetlands International/CIRAD/FAO 70 **Wild birds and Avian Influenza in Africa: summary of surveillance and monitoring programmes** English: http://wildbirds-ai.cirad.fr/index.php	Scientists & veterinary professionals	General
European Commission 71 **Results of EU avian influenza surveillance in poultry and wild birds** English: http://ec.europa.eu/food/animal/diseases/controlmeasures/avian/eu_resp_surveillance_en.htm	Policy makers & scientists	Technical
HEALTH & SAFETY		
British Trust for Ornithology (BTO) 72 **Disease from birds, with particular reference to avian influenza** English: http://www.bto.org/ringing/diseases-from-birds.doc	Bird banders/ringers	General
Health & Safety Executive (United Kingdom) 73 **Working with highly pathogenic avian influenza virus** English: http://www.hse.gov.uk/biosafety/diseases/avianflu.htm	Scientists	General
US Fish & Wildlife Service 74 **List of guidelines for hunters and bird handlers** English: http://www.fws.gov/migratorybirds/issues/AvianFlu/WBAvianFlu.htm	Animal handlers & hunters	General
COMMUNICATION, EDUCATION AND PUBLIC AWARENESS (CEPA)		
GENERAL		
World Conservation Union (IUCN) 75 **IUCN Species Survival Commission Media Guide** English: http://www.iucn.org/themes/ssc/for_members/media_guide.htm	Those responsible for briefing the media, public, policy makers	General

Science and Development Network 76 **Dealing with the media** English: http://www.scidev.net/ms/sci_comm/index.cfm?pageid=191	Those responsible for briefing the media, public, policy makers	General
GREEN Communications 77 **Green Guide to effective public relations** English: http://www.greenblog.co.uk/files/guide-to-effective-pr.pdf	Those responsible for briefing the media, public, policy makers	General
Civicus 78 **Civicus Toolkit on handling the media** English: http://www.civicus.org/new/media/Handling the Media.pdf	Those responsible for briefing the media, public, policy makers	General
Scientific Task Force on Avian Influenza & Wild Birds 79 **Avian influenza and wild birds information brochures (Avian Influenza & Wild Birds: What is their actual role in the spread of the virus?)** English: http://www.aiweb.info/documents/AI_brochure_English.pdf French: http://www.aiweb.info/documents/AI_brochure_French.pdf Spanish: http://www.aiweb.info/documents/AI_brochure_Spanish.pdf Russian: http://www.aiweb.info/documents/AI_brochure_Russian.pdf Arabic: http://www.aiweb.info/documents/AI_brochure_Arabic.pdf Chinese: http://www.aiweb.info/documents/AI_brochure_Chinese.pdf	Those responsible for briefing the media, public, policy makers	General
Ramsar Convention on Wetlands 80 **Handbook 4: Wetland CEPA** English: http://www.ramsar.org/lib/lib_handbooks2006_e04.pdf French: http://www.ramsar.org/lib/lib_handbooks2006_f04.pdf (Manuel 4: CESP-Zones humide) Spanish: http://www.ramsar.org/lib/lib_handbooks2006_s04.pdf (Manual 4: CECoP sobre los humedale)	Site managers & those responsible for briefing the media, public, policy makers	General

2) Guidelines for reducing avian influenza risks at Ramsar sites and other wetlands of importance to waterbirds

2.1) Summary

25. These guidelines[3] have been produced in response to a request from Ramsar Contracting Parties at COP9 for guidance on practical measures to reduce risks of highly pathogenic avian influenza (HPAI) for managers of wetland areas. They are intended to reduce the potential risk of outbreaks of the disease at wetlands of national and international importance for waterbirds by proposing a range of measures that can be taken before any outbreaks have occurred.

26. Most of these measures should be systematically planned on the basis of a risk assessment for the site, within the context of site management plans and outbreak response plans (see guidance in Section 1).

27. The guidelines draw to a large extent on existing material, and links to sources are provided throughout.

28. Section 2.3 on risk assessment follows the Ramsar Convention's Wetland Risk Assessment Framework (Ramsar Convention Secretariat 2007a). The application of this framework to assess the risks of HPAI occurrence at a site (i.e., a specific animal health problem) may have some shortcomings, but the general approach of problem identification, impact prediction, estimation of the extent of impacts, and overall assessment of the risk of adverse impacts, leading to risk management and reduction measures, monitoring and communication with all stakeholders, is recommended as good practice.

29. Section 2.4 on risk reduction (or management) measures describes how managers of an individual wetland or a system of wetlands and other protected areas establish systematic measures to reduce the overall risks of HPAI transmission, based on common principles. As the situation at each site will be different, specific risk reduction measures should be undertaken at each site so that local efforts can be focused on controlling the most significant risk factors. This section lists a range of measures that can be incorporated in site management plans to ensure a systematic and pre-emptive approach towards managing HPAI risks at sites.

30. Section 2.5 covers surveillance programmes, focusing on their application at sites. These are essential for better understanding the disease, monitoring its development, and

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[3] These guidelines were originally produced under the framework of the UNEP/GEF Siberian Crane Wetlands Project (SCWP), in response to international concern over the threat that HPAI H5N1 poses to waterbird populations, including globally threatened species such as the Siberian Crane *Grus leucogeranus*. This project aims to develop networks of well-managed wetland protected areas to support migratory waterbird populations in East and West/Central Asia in cooperation with other flyway conservation initiatives and to address specific threats at selected key sites. The original UNEP/GEF SCWP guidance was reviewed and subsequently revised by the STRP to provide guidance that is more broadly applicable to a range of wetlands, including Ramsar-listed Wetlands of International Importance, individual wetlands and wetland systems of importance to waterbirds, and to aquatic protected areas more generally.

contributing to early warning systems. They should incorporate the results of risk assessments that have identified those species likely to be at higher risk of carrying the HPAI H5N1 virus, as well as the best strategic design (including optimal selection of sampling sites) and methods of sampling these species. This requires action at many scales, including more effort at national and site levels to monitor the health of wild birds.

31. Section 2.6 deals with outbreak response planning – reducing the risks of significant impacts in the case of an HPAI outbreak, primarily through ensuring that procedures are in place for a rapid response. It lists specific questions for site managers to consider when preparing an outbreak response plan and a format for ornithological information to support response needs.

32. Although these guidelines are aimed at reducing the risks and impact of HPAI, they also provide a framework for managing other emerging or re-emerging diseases at wetlands, particularly infectious processes.

2.2) Introduction

33. The guidelines are intended to reduce the potential for outbreaks of HPAI H5N1 of Asian lineage at wetlands of importance for waterbirds through a range of measures that can be taken by site managers before any outbreaks have occurred. Most of these measures should be systematically planned on the basis of a risk assessment for the site, within the context of site management plans and outbreak response plans. A holistic and participatory approach to the risk assessment and plans is advocated here in order to improve their effectiveness.

34. The purpose of these guidelines is to provide the managers of wetlands with a series of relatively simple procedures and actions that will effectively reduce the risks of avian influenza virus transmission among domestic birds, wild birds, and people.

35. The guidelines have been kept concise and relatively simple in order to facilitate their use in the widely varied circumstances of wetland areas worldwide. More detailed information can be obtained through the guidance directory in Section 1.3. Contact details of international organizations concerned with avian influenza and wild birds can be obtained from the Scientific Task Force on Avian Influenza and Wild Birds' AIWEb website (http://www.aiweb.info).

36. The outbreak and spread of the HPAI H5N1 in recent years has led to widespread concern about the potential impacts on human health (especially the risk of a global influenza pandemic), the poultry industry, and the conservation of wild birds. These guidelines focus on the last aspect and are based on the available literature on HPAI H5N1 and the recommendations of international conservation conventions, FAO, OIE, and WHO, as well as selected national sources. The Scientific Task Force on Avian Influenza and Wild Birds in particular has coordinated international scientific advice on the conservation impact of avian influenza.

37. While there are numerous sources of information and advice on the HPAI H5N1, few of these relate to the management of natural areas for wild birds. Recent work for the European Union (Wetlands International & EURING 2006; Veen *et al.* 2007) identified species that might pose a higher potential risk of spreading HPAI H5N1 along their

migration routes to the EU. Analyses of migration routes of these so-called 'higher risk' species (on the basis of ringing recoveries) identified wetland sites where such species concentrate. While this approach has not yet been applied to other regions, it is of particular relevance to these guidelines.

38. When planning control measures at individual wetland sites, it is essential that managers should obtain information on the respective national policies, legislative and administrative arrangements, and action plans and contingency plans through the related authorities for human health, animal health, and the environment in their countries.

39. Throughout these guidelines the term 'poultry' is defined, following OIE, as 'domestic birds bred for meat, eggs, feathers, etc., including chickens, turkeys, ducks, geese, quail, etc.'.

Avian influenza and wild birds

40. Wild birds, especially waterfowl and waders/shorebirds, are the natural reservoir of low pathogenic avian influenza (LPAI) viruses. These hosts and their viruses have become well-adapted to each other over time and infection does not usually cause overt disease in wild birds, although recent studies indicate that some behavioural changes may occur in response to infection (van Gils *et al.* 2007). These low pathogenic viruses replicate mainly in the intestinal tract of aquatic birds and are usually transmitted in the faeces. Thus, transmission in aquatic birds is by the faecal-oral route, i.e., wetland habitats provide the natural source of infection for other individuals.

41. The HPAI H5N1 virus infecting poultry, other domestic animals, wildlife, and humans almost certainly originated from the mutation of a LPAI virus on poultry farms and/or markets in east Asia. The virus has spread rapidly within and between farms, taking advantage of local practices in the feeding, housing, slaughtering, and trade of domestic ducks, chickens and geese. Poor hygiene, overstocking, and mixing of different domestic animals greatly increases the risk of spreading the infection. As a result the virus is now considered to be endemic in poultry of east and southeast Asia (Scientific Task Force on Avian Influenza and Wild Birds 2006).

42. Close contact between wild birds and poultry can lead to cross-infection, from poultry to wild birds and from wild birds to poultry. This has caused mortality in many species of wild birds including swans, geese, ducks, cormorants, grebes, gulls, herons, egrets, storks, and raptors, with most reports coming from Europe and Asia.

43. It is clear that legal and illegal trade in domestic poultry has been a crucial factor in the spread of infection both locally and over long, even cross-continental distances, although its relative significance seems to have varied at different times and in different places (Gauthier-Clerc *et al.* 2007; Kilpatrick *et al.* 2006). However, analysis of genetic sequences and other largely indirect evidence suggest that wild migratory birds are also likely to have contributed to further spread (see Chen *et al.* 2006; Kilpatrick *et al.* 2006; Hesterberg *et al.* 2007). The relative importance of different modes of viral spread, however, is unclear in the present state of knowledge.

44. Further background information is provided in Appendix 1.

2.3) Risk assessment

Introduction

45. The rapid emergence of HPAI H5N1, its high level of pathogenicity for poultry and some wild bird species, and its transmission to humans in close contact with poultry have together resulted in a major global response.

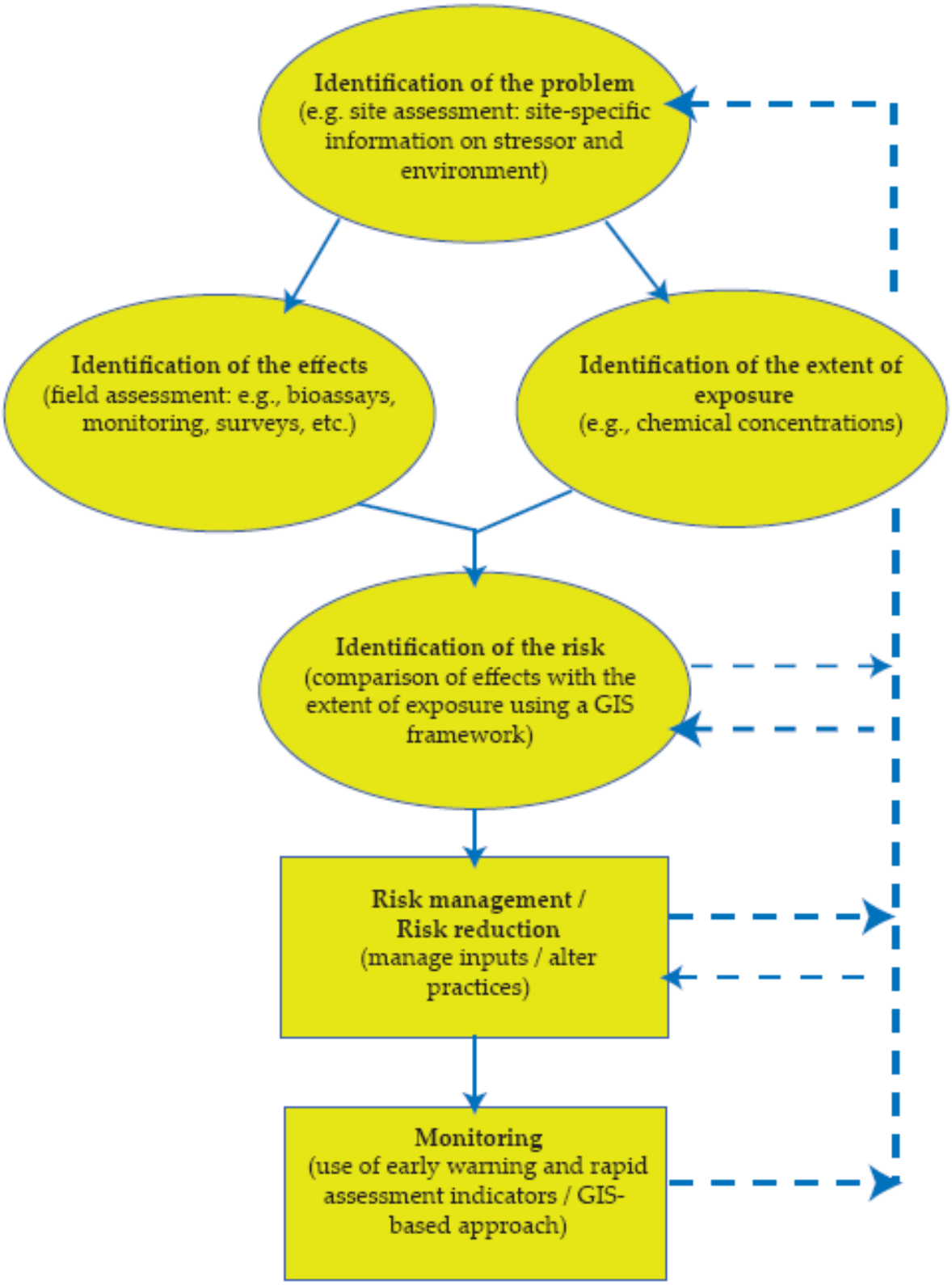
46. However, many aspects which may be important in the spread of this subtype of avian influenza virus are poorly understood, including its epidemiology in wild birds and other wildlife, its persistence in the environment, the exact migratory routes used by many bird species, the trade routes (both legal and illegal) used for poultry and poultry products, and the extent of its spread by both the legal and illegal trade in wild birds. At the site level, often little quantitative information is available on the assemblage of bird species present in any particular month of the year, their use of neighbouring areas, and the dynamics of local wetland ecosystems as well as of local poultry enterprises.

47. UNEP (2006) recommends that all countries should undertake risk assessments which should be transparent, structured, and science-based and make use of all available knowledge. In the face of all this uncertainty, the development of accurate risk assessments for both countries and individual wetland sites is problematic. This reflects the need to give priority to applied research, monitoring, and surveillance so that risk assessments and related management actions can be more targeted and accurate. UNEP (2006) provides recommendations on data, information and research needs, emphasizing the importance of enhanced field surveillance efforts.

48. However, it is important to make efforts using the best available information to reduce risks at Ramsar sites and other wetlands, starting with a site risk assessment.

49. The Ramsar Convention's Wetland Risk Assessment Framework (Ramsar Convention Secretariat 2007a) provides a mechanism for predicting and assessing change in the ecological character of wetlands, and it promotes the usefulness of early warning systems. This framework is outlined in Figure 1 and explained further in Ramsar's *Handbook on Inventory, Assessment and Monitoring* (Ramsar Convention Secretariat 2007a). The application of this framework to assess the risks of HPAI occurrence at a site may have some shortcomings, as Ramsar's Wetland Risk Assessment Framework was not designed with a specific animal health problem in mind. However, the general approach of problem identification, impact prediction, estimation of the extent of impacts, and overall assessment of the risk of adverse impacts, leading to risk management and reduction measures, monitoring and communication with all stakeholders, can still be recommended as good practice.

Figure 1. Model for wetland risk assessment (Ramsar Convention Secretariat 2007a)



Step 1 - Problem identification

50. This step involves recognizing the nature of HPAI H5N1 pathogenicity, means of transmission, etc. While much about the virus and epidemiology of the disease remains unknown, some key points are summarized below (see Appendix 1 for more details):

    i) HPAI H5N1 has infected a wide range of birds and some domestic and wild mammal species.
    ii) The virus has shown high virulence in most poultry, and infected birds have usually died quickly; there is some evidence that some experimentally infected waterbirds can survive while shedding virus (e.g., ducks, geese, swans and gulls: Chen *et al.* 2006; Hulse-Post *et al.* 2005; Brown *et al.* 2006; Brown *et al.* 2008);
    iii) Cross-infection can occur between domestic / captive birds and wild birds (in both directions), although actual transmission mechanisms are largely undocumented.
    iv) Some species are thought to be at a higher risk of infection than others due to their behavioural and ecological characteristics (Wetlands International & EURING 2006; Veen *et al.* 2007).
    v) Although information is still lacking, there is likely to be great variability in the survival of virus in the environment, especially in faecal and other organic material, with temperature, pH, salinity and UV radiation all affecting viral viability.

51. It is therefore important to gather information on ecological aspects of, and human activities within, a site to ensure that the problems can be subsequently both quantified and qualified.

Step 2 – Identification of the adverse effects

Timing of possible outbreaks

52. The potential adverse effects will depend largely on which bird species are present at the site at different times of the year (residents, breeding visitors, non-breeding visitors, passage migrants, and nomadic or irruptive species). The seasonal timing of an outbreak will significantly affect the risks to bird populations owing to the varying presence of different species. Similarly, there may be other relatively predictable times of increased risk due to people and poultry activities, for example, during times of poultry movements, times when people or vehicular access to the site is greater, or times when there is application of fertiliser which may contain potentially infected poultry manure.

Bird distribution on site

53. Bird species occupy different parts of the site according to habitat preferences and daily behavioural patterns (feeding, roosting, bathing/drinking). Most bird species are more sedentary during the breeding and moulting season, remaining within breeding territories or on moult sites.

54. Some species will be present in dense flocks, some in loose dispersed flocks, and others as small groups or individuals. Most species will mix with other species at a site during the course of their stay.

55. Some bird and mammal species will remain far from human habitation, while others are attracted as it offers benefits such as food sources, shelter, nesting and safety from predators. These species, such as sparrows, starlings, crows, pigeons, rats and mice have the potential to carry disease between industrial or domestic poultry and wild birds, and thus they are known as "bridge species" (see Highly Pathogenic Avian Influenza Infection Route Elucidation Team 2004; Veen *et al.* 2007).

Presence of species of high conservation importance

56. The presence of globally threatened species (more than 1% of a biogeographic waterbird population or more than 20,000 waterbirds) is among the criteria which determine the international importance of a wetland for waterbirds. Important Bird Area criteria include the presence of restricted range and endemic species. Consideration of species of high conservation importance should be a priority during risk assessments, with the aim of reducing the level of risks to such species.

57. It should be noted that HPAI H5N1 has also infected several mammal species, with scavengers and predators of dead birds likely to be most at risk (see Appendix 1).

Step 3 – Identification of the likely extent of the problem

58. Prediction of the extent of HPAI outbreaks at a site is difficult, in view of the scarcity of information about outbreaks in wild birds. Points for site managers to consider are:

- If the outbreak occurs in poultry, the biosecurity of the facility, early diagnosis of the disease, and speed of response in controlling the outbreak and preventing its further spread are all of critical importance.
- If poultry and their wastes are kept in biosecure facilities away from the wetlands, the risks of cross-infection to wild birds should be much reduced.
- The virus can survive in water and spread through wetlands. Waste from poultry facilities should not be allowed to enter wetlands, and for the same reason water supplies for poultry facilities should come from clean sources.
- Outbreaks in wild birds appear to have been largely self-limiting – e.g., Jungle Crows *Corvus macrorhynchos* in Japan in 2004 (see Highly Pathogenic Avian Influenza Infection Route Elucidation Team 2004; Sabirovic 2006) – but recorded mortality has been high in some situations, e.g., at Qinghai Lake, China, in May 2005.
- Some species appear to be more vulnerable to infection, such as swans, ducks and grebes.
- Wild birds often move outside the wetland's boundaries to other areas in the surrounding landscape. For instance, ducks, geese, swans and cranes may feed on agricultural fields and use the wetland for roosting. Fish-eating birds like cormorants may commute between wetlands, rivers, fishponds. and coastal areas. In such cases, wider assessments of the risk of cross-infection and spread are thus needed.

Step 4 – Identification of the risk

59. This involves integrating the results from the assessment of likely effects (Step 2) with those from the assessment of the likely extent of the problem (Step 3). A range of techniques exist for estimating risks, often depending on the type and quality of likely effects and their extent. Mapping of the assessments with GIS can be used to link the effects to impacts (e.g., poultry facilities on or near the site, other human activities, distribution of key species at the site across different seasons, seasonal changes in water levels leading to concentrations of wild bird species or wild and domestic birds, important roost sites (either temporary or permanent), wetland margins and crop patterns in adjacent landscapes).

60. This may indicate that the risks caused by an outbreak are higher during the peak migration and non-breeding period for some sites – or the opposite for other sites which have, for example, breeding waterbird populations in summer and are frozen during the winter.

61. Also, the risks posed by infection at sites containing high concentrations of birds (e.g., dense flocks of swans, geese, ducks and cranes) may be relatively high if there are significant infection routes (perhaps bridge species, presence of captive birds, poultry, or feeding stations).

2.4) Risk reduction measures

Principles

62. Wetland site managers can implement a series of measures that should effectively reduce the risks of HPAI transmission between domestic birds, wild birds, and people at their sites. As the situation at each site will be different, risk reduction measures should be undertaken at the scale of individual sites so that local efforts can be focused on controlling the most significant risk factors.

63. However, managers of individual sites and wetland systems can also put in place systematic measures which should reduce the overall risks of HPAI transmission across all sites. The general principles of these measures are to:

    i) physically separate wild birds and domestic/captive birds (including poultry), their food and water sources, and their waste where this is feasible;
    ii) improve biosecurity arrangements for domestic/captive birds;
    iii) control environmental transmission routes for the virus on the site and, where appropriate, when leaving the site, e.g., via wild, captive or domestic birds and fomites (inanimate contaminated objects such as footwear or vehicle wheels);
    iv) improve surveillance and reporting of the health of domestic/captive birds and wild birds;
    v) improve the knowledge base on the use of the site by wild birds and potential bridge species; and
    vi) be fully prepared with a response plan in the event of an outbreak (see Section 2.6).

64. There is wide international consensus that attempting to control HPAI through responses such as culling or disturbing wild birds, or destroying wetland habitats, is not feasible and should not be attempted, not least since it may exacerbate the problem by causing further dispersion of infected birds. Resolution IX.23 of the Ramsar Convention on Wetlands states that the "destruction or substantive modification of wetland habitats with the

objective of reducing contact between domesticated and wild birds does not amount to wise use as urged by Article 3.1 of the Convention, and also may exacerbate the problem by causing further dispersion of infected birds". These conclusions were also highlighted by the Convention on Migratory Species (CMS) Resolution 8.27 and the African-Eurasian Waterbird Agreement (AEWA) Resolution 3.18.

Management planning

65. Wetlands, particularly Ramsar sites, are most effectively managed through site management plans (Ramsar Convention Secretariat 2007b; Chatterjee *et al.* 2008). Wetland management plans provide a systematic approach to the maintenance of conservation values, sustainable use of natural resources, and other land uses including research, education, and economic activities. Management plans provide a basis for controlling land uses and other activities within the relevant wetland areas when supported by legislation and regulations, and when there is a strong relationship between the management authorities and local stakeholders (e.g., through participatory management approaches and environmental education programmes). Management plans still provide a systematic means of implementing policies and initiatives if these enabling conditions are less than ideal.

66. Local measures related to reducing HPAI risks will usually be related to **site management objectives** concerning the following subjects:

A. conservation of waterbird populations;
B. conservation of threatened or endemic bird species;
C. captive breeding/reintroduction of wild bird species on site;
D. agricultural practices within, adjacent to, and upstream of the site;
E. sustainable use of natural resources (including hunting);
F. human access to different parts of the site;
G. communication, education and public awareness programmes; and
H. stakeholder participation and inter-agency communications.

A. Conservation of waterbird populations

67. One of the main concerns for reserve management will be to maintain the value of the site for waterbird populations, although the details will vary by site, e.g., breeding, staging, and/or over-wintering birds. Reserve management needs to have reliable information on the distribution of these birds across the site and surrounding areas in different seasons, supported by an ongoing monitoring programme.

68. In many cases the parts of the sites used by these birds will be distant from human activities due to factors such as habitat distribution, protection, regimes and disturbance. Situations can occur, however, when wild birds will inevitably come into close proximity with people and their activities:

i) small or linear sites surrounded by dense human populations (e.g., coastlines and rivers near cities, lakes near urban centres);
ii) small sites located in intensive agricultural landscapes or densely populated rural areas;
iii) sites where feeding of wild birds occurs, either by site managers or the public;

iv) sites where domestic/captive birds are present on the wetlands or around their margins, or on water courses that drain into them;
v) sites where wild birds feed on agricultural land inside or around a protected area; or
vi) large sites that include human settlements and are used for natural resource exploitation (fishing, hunting, collection of other wetland products, grazing, etc.).

69. In general, best practice measures should be put in place to minimize contact between wild bird populations and domestic/captive birds (including poultry) and their waste. Some of these measures are outlined in Section 2.4.

70. In situations of heightened risk, further measures should be taken to minimize contact between wild bird populations and domestic/captive birds (including poultry), as well as people, although this may be difficult to achieve in some situations. Some practical steps that can be taken are:

i) to zone land uses to separate human activities;
ii) to restrict human and vehicular access to those parts of the site where contact with wild bird populations is minimal, in the case of virus circulation at the site or in its surroundings, in order to reduce risk of onward spread of infection and minimise human health risks. This can be done through management zones, controls on vehicle access, fencing, etc. (see Section 1.3 for examples);
iii) to further constrain movements of free-flying or feral birds;
iv) to prohibit use of live decoy birds for hunting/trapping, releases of birds for hunting activities, and "merit releases" of captive birds (the traditional custom of releasing caged birds at certain times of the year as part of religious practices, especially in Asian countries);
v) to prohibit public feeding and hunting of wild birds in the case of HPAI outbreaks;
vi) to consider alternatives to the feeding of wild birds by reserve managers in order to avoid over-concentration of wild birds and related disease transmission risks; and
vii) to promote public education to raise awareness of HPAI, the risks it poses, and some simple precautions and response actions.

71. Regulations may be required to ensure enforcement of the above measures.

B. Conservation of threatened or endemic bird species

72. For threatened or endemic species, generally the same measures as for other waterbird populations should be undertaken, although any restrictions on access and activities would be for those parts of the site used by the threatened species. Effective conservation measures will require detailed information on the distribution of these species at the site (including those areas used for feeding, bathing, roosting, and nesting, and seasonal changes in these), supported by monitoring programmes.

C. Captive breeding/re-introduction of wild bird species on site

73. According to D. Armstrong, "Disease is increasingly recognized as a significant risk factor in conservation programs involving animal movements such as reintroduction or translocation. Disease risk poses threats not only to the species on which programs are focused but also to other species that share the habitat. The concern over disease processes and their impact extends across diverse areas of interest including the fields of

conservation biology, wild and zoo conservation management and veterinary medicine as well as to agricultural medicine and human medical fields. However disease risk has proven to be complex and difficult to assess and quantify in the context of a conservation program. The growing recognition that disease issues can profoundly affect the viability of populations and consequently the success or failure of conservation programs has led to diverse efforts by individuals and groups to develop some rational means to:

i) assess the risks that disease poses to these programs;
ii) develop well reasoned understandings of the factors and issues involved; and
iii) make reasonable decisions based on these assessments." (Armstrong *et al.* 2003).

74. Some wetland protected areas maintain collections of captive wild birds, for public education and display, research, captive breeding and release programmes to bolster wild populations of rare and endangered species. In general, such collections of captive birds should not be allowed to mix with wild birds – they should be kept in aviaries and not allowed to roam freely around the site. Preventing wild birds such as sparrows, starlings, pigeons, crows and gulls from entering enclosures is difficult unless they are completely enclosed with roof-netting and sheltered feeders are provided. See Section 1 for examples of guidelines.

75. In addition, in order to reduce virus transmission, water and waste from captive bird collections should not be allowed to enter natural wetlands. This will be difficult to achieve in some sites with established collections without the construction of water management structures or water treatment facilities.

76. Birds to be released from the captive breeding facility as part of reintroduction programmes should undergo thorough pre-release health screening as recommended by IUCN's Reintroduction Specialist Group (IUCN 1998).

77. There are many existing guidelines on good health care and biosecurity for poultry and captive birds, e.g., reducing risks from personnel movements, bird movements, and contaminated food and water – see Section 1 for examples, including FAO guidelines on avian influenza and keeping small-scale poultry (in different languages).

78. Captive bird populations should be kept under surveillance for HPAI and other infectious diseases, sick birds should be quickly quarantined, and causes of death should be investigated in a timely manner .

79. It is worth emphasizing that under unusual circumstances such as crowding, HPAI H5N1 could be devastating. The crowding of birds can be regarded as a pervasive threat, with HPAI H5N1 as just one example among many infectious diseases that could lead to significant mortality.

80. In view of the significant risks posed by a potential outbreak of HPAI H5N1, collections of high conservation value species should develop and test contingency plans (using similar principles to those within these guidelines). These should include having good biosecurity arrangements in place, and managers should consider dispersion to separate cage facilities or sites to reduce risks. Where appropriate, consideration should be given to vaccination of captive birds with the aim of reducing mortality and potential viral shedding.

81. Wildlife rehabilitation facilities should also be reviewed for biosecurity and preferably kept separate from captive bird collections to reduce risks of introducing disease.

D. Agricultural practices within, adjacent to, and upstream of, the site

82. There are a number of agricultural practices which have the potential to increase the risks of HPAI infection on site, among which are:

    i) intensive poultry farming (chickens, turkeys, quail, ducks and geese);
    ii) domestic poultry rearing (generally small scale for subsistence) and rearing exotic birds (pigeons, pheasants, ornamental waterbirds, etc.);
    iii) draining of waste water and poultry wastes into drains that are connected to wetlands;
    iv) spreading organic manure from poultry farms as fertilizer on farmland; and
    v) using fish food that includes poultry manure as an ingredient for aquaculture.

83. In general, intensive poultry rearing is not a suitable activity for a wetland that is important for waterbirds, and this should be reflected in the management plan for the site and the management regime for the wetland. This may become a cause of conflict where intensive farms already exist, and often wetlands are considered suitable environments for free-range duck farming. In such cases, the options include:

    i) improving the biosecurity of the farm as far as possible so that there is no connection with wild birds or the wetland system;
    ii) relocating the farm to another place with no connection to the wetland system; or
    iii) closing the farm down and compensating the owners.

84. Which approach is appropriate will need to be determined locally.

85. Small-scale poultry rearing is harder to control (see Section 1.3), but in general birds should be kept indoors or in an enclosure and off the wetland system. If the risk is considered to be high, the activity could be banned in certain management zones within a wetland protected area.

86. Manure from intensive poultry farms is commonly used as a fertilizer on agricultural land. It is recommended that this practice should be banned completely within wetlands in order to reduce disease risks. The option of controlled usage in specified areas (e.g., away from wetlands) can be considered, but attention should be paid to spillage along access routes, drainage off fields into the wetlands, and use of fertilized fields by wild birds. In these situations, a pre-treatment for poultry manure through heat or sun-drying that inactivates viruses is recommended.

87. Any fish food used on-site for aquaculture should not include poultry manure or other poultry byproducts as an ingredient. Alternative foods are available.

E. Sustainable use of natural resources (including hunting)

88. Public access to parts of the wetland site can provide the benefit of improved reporting of unusual occurrences of sick or dead birds, especially if public education is conducted.

89. In the event of a reported HPAI outbreak at or near a site, it is recommended that management authorities contact hunting representatives and immediately stop hunting and trapping of wild birds at the site until further notice. Continued shooting may cause infected birds to disperse as a result of disturbance. Additionally, hunters are at increased risk of infection from handling killed birds and therefore should be warned (see health and safety section below).

90. The use of live decoy birds should be prohibited at high risk sites. European Union Member States, Decision 2005/734/EC elaborates on conditions where the use of live decoys may be allowed, including individual numbered bands on decoy birds and biosecurity measures for their upkeep (European Commission 2005). This guidance may be useful outside the EU as well.

F. Health and safety aspects

91. The main risks involved through the use of natural resources relate to bringing people into close contact with wild waterbird populations, placing people theoretically at risk of HPAI infection from wild birds. Where an assessment of the risk suggests that virus is not circulating in poultry or wild birds in the geographical area concerned, then no specific control measures are considered necessary. It is worth noting that previous live wild bird surveillance suggests that prevalence is low even where there have been active outbreaks of HPAI H5N1 in poultry.

92. General advice should be provided to the public not to handle sick wild birds or those found dead and to report any unusual incidents to a specified authority immediately. An emphasis should be placed on good hygiene practices such as washing hands after handling any birds, and not eating, drinking or smoking until hands have been washed. More detailed guidance is available from a number of sources listed in Section 1.3.

93. Hunters (including waterbird trappers) and bird ringers/banders are at a slightly higher risk because they handle freshly killed or live wild birds. Guidelines for hunters and bird ringers/banders are available on a number of websites (Section 1.3). Guidance generally encourages good hygiene practices such as washing hands after handling killed birds; de-feathering in well-ventilated areas; not eating, drinking or smoking until hands have been washed; and ensuring that shot birds are cooked properly.

G. Human access to different parts of the site

94. As noted above, public access to parts of the site can provide the benefit of improved reporting of unusual occurrences of sick or dead birds, especially if public education is conducted.

95. At times of low risk, i.e., when there have not been reports of HPAI in the region, there is no reason to impose additional controls on human access. At times of increased risk, e.g., when HPAI has been reported in the region, restrictions should then be considered. Management zoning for wetland protected areas should seek to create zones where important feeding and roosting concentrations of migratory waterbirds, breeding colonies, and rare and endangered species are not disturbed by human presence. Regular human disturbance effectively reduces the extent of suitable habitat and increases the stress on individual birds through reduced feeding opportunities and increased energy expenditure

and may lead to increased disease susceptibility. Certain activities such as hunting, jet-skis, and speedboats create more disturbance than, for example, walking or cycling.

96. For health and safety advice for the general public, researchers, hunters, ringers/banders and others, see above or Section 1.3.

H. Communication, education and public awareness programmes

97. Public education is an important proactive measure that site managers can take in order to ensure that local stakeholders are informed with sound, balanced factual information about HPAI, the risks it poses, and the measures that they can take to protect themselves. It should also indicate how they can contribute towards reducing HPAI risks at the site and provide clear information about the communication lines in case of an outbreak.

98. It is suggested that the main target groups for HPAI awareness programmes should be members of any existing site management committee (such as local government agencies, community leaders, hunting and trapping associations, NGOs), local residents and users of the wetlands, and schools. Local public health and veterinary services should always be involved.

99. Communication needs to be tailored for the local situation and kept simple (see Alders & Bagnol 2007 and other guidance sources in Section 1).

100. Simple information leaflets or posters in local languages are among the most effective ways of reaching a wide range of people around the site.

101. Reporting of dead or sick birds by the public and others should be encouraged as part of surveillance programmes (see Section 2.5), with procedures for simple reporting systems communicated widely.

I. Stakeholder participation and inter-agency communications

102. Wetland site managers need to appreciate the wide range of agencies that may be involved in an HPAI outbreak response, from human and animal health professionals to local government, law enforcement professionals, and environmental authorities. Indeed, one of the major challenges posed by HPAI is the need for efficient inter-agency coordination among these stakeholders. The formation of national committees including all relevant organizations has been found valuable by several Contracting Parties and is recommended good practice (see also Sections 1 and 4). This needs to include coordination at a local level as well.

103. These coordination mechanisms should be agreed and set out in an outbreak response plan (see Section 2.6). The outbreak response plan should be shared with all key stakeholders so that it can be followed correctly. All contingency and communications plans need to be formulated, and relationships developed, in 'peacetime', i.e., prior to increased risk of disease. The running of scenario-based exercises will help to ensure that plans are fit for purpose.

104. Site management plans provide a practical framework for establishing measures to minimize HPAI risks on a site specific basis. These should be discussed and agreed with

stakeholders so that they can be implemented efficiently, with local cooperation and support. It is recommended that public education measures be undertaken first, so that the stakeholders understand the risks involved and how they can contribute towards the collective security of the site.

2.5 Wild bird surveillance

105. Comprehensive surveillance programmes are essential for better understanding the disease, monitoring its development, and contributing to early warning systems. They should incorporate the results of risk assessments that have identified those species likely to be at higher risk of carrying HPAI H5N1, as well as the best strategic design (including optimal timing of surveillance and selection of sampling sites) and methods of sampling these species. This requires action at many levels, including more effort at national and site levels to monitor the health of wild birds. Interest groups, such as hunters and birdwatchers, can play a vital role in the monitoring and reporting of dead birds or unusual mortality, provided their members are trained to minimise risks of self-infection and spread of the disease. In addition to bird trappers supplying samples for active live bird surveillance, hunters can also be useful for supplying samples from birds killed as part of normal hunting activities.

106. Significant efforts have already been made to try to understand the role of wild birds as vectors of HPAI H5N1, as well as the actual and potential impact of the virus on wild populations of conservation concern. Many countries have initiated or reinforced surveillance programmes aimed at determining the presence and extent of the virus in wild bird populations.

107. In 2005, a Global Avian Influenza Network for Wild Bird Surveillance (GAINS) was established in order to build capacity for field operations for collection of samples from wild birds, improve the understanding of virus strains and transmission of influenza viruses in wild birds, and disseminate information to all levels of governments, international organizations, the private sector, and the general public.

108. Surveillance should:

i) be undertaken with clearly set objectives;
ii) be conducted with standardised protocols in line with national and international programme requirements, including appropriate consideration for health and safety and legal and ethical aspects and in cooperation with relevant local and national authorities;
iii) strive always to identify birds to species level and report these data (see guidance in Section 3), where possible including broader contextual epidemiological data (e.g., age, sex, and proportion of population affected);
iv) consider monitoring methods that are both active (sampling live or shot/killed birds, or active targeted dead bird surveillance) and passive (wider sampling of birds found dead);
v) establish sampling methods that follow recognized standard protocols (e.g., major FAO guidance documents listed in Section 1.3);
vi) involve, as appropriate, public reporting of target species' mortality and morbidity. Contact numbers and procedures for reporting dead and sick birds should be widely publicised;

vii) ensure high quality data with appropriate validation procedures;
viii) ensure that results are reported in a timely fashion to ensure their maximum utility, including use of initiatives such as GAINS; and
ix) be coordinated at a subnational, national and international level.

2.6 Outbreak response planning

109. The final and crucial step concerns reducing the risks of significant impacts in the case of an HPAI outbreak, primarily through ensuring that procedures are in place for a rapid response. Outbreaks of HPAI H5N1 among wild birds typically occur unexpectedly, confronting site managers with an emergency situation that demands immediate action. Managers, together with local and national authorities, will have to take decisions about restricting human use of the site, monitoring bird mortality, and possibly sampling to assess presence and extent of infection.

110. It is important to note that national veterinary authorities are responsible for responses to HPAI H5N1 cases in wild birds. The Chief Veterinary Officers of the 170 member countries of OIE have obligations to report to OIE all cases of HPAI in wild birds and any control measures undertaken. Communication to the public also falls both within their competence, as well as that of respective public health authorities, and this must be handled with care. **Site managers should always ensure full cooperation with relevant authorities and should inform themselves of national and other policies before outbreaks occur.**

111. Specific questions for site managers to consider when preparing an outbreak response plan include:

- What are the existing national and/or subnational regulations, plans or guidelines for HPAI outbreaks?
- Who are the responsible human health, animal health, and environmental protection authorities? Contingency plans should provide contact details (such as mobile phone numbers) so that rapid contact can be made with key individuals.
- What equipment needs to be kept on site to respond to an HPAI outbreak? Personal protective equipment, cleansing and disinfection equipment, and storage facilities for samples are amongst items to be considered.
- If dead or sick birds are found, what procedures should be followed in order to confirm the cause of death?
- Who needs to be informed at a local level? Contact details should be gathered in advance.
- At what stage should control measures be put in place?
- How will the public be informed and when? Is there a standard message that can be prepared in advance and used in the event of an outbreak?
- How will the media be dealt with? Is there a standard message that can be prepared in advance and used in the event of an outbreak?
- What controls on access to the site are required? How will these be implemented? Are cleansing and disinfection facilities available for decontaminating vehicles, etc.?
- How can the local spread of the disease be quickly contained?

- What measures are needed to protect reserve staff and their families, or others, living on site?
- Who are the local ornithological and related experts who can assist rapid response measures in the case of an outbreak? Contact details should be gathered in advance.
- Where can the necessary information on bird distribution, movements and other related information, such as existing HPAI surveillance data, be accessed?

112. As for formation of stakeholder groups and communication strategies, full outbreak response plans need to be formulated in 'peacetime', i.e., before risk of HPAI outbreaks. Moreover, these plans need to be tested by scenario-based exercises. Such exercises involving all stakeholders will improve preparedness by both fine-tuning plans and providing staff training.

113. Any outbreak of HPAI H5N1 in a wetland site in domestic/captive or wild birds will also lead to a series of questions, which necessitate quick answers. Such questions include:

- How many birds are affected and which species are involved? What proportion of the population does this constitute?
- Are there 'higher risk' species[4] present and in what numbers?
- Are there concentrations of roosting/nesting birds that use the site?
- Is there a special risk for transmission of the virus to and from poultry in the neighbourhood and, if so, which species can be expected to be involved?
- Are there endangered species present which might need special attention and/or protection?
- Are there any neighbouring sites to which the virus might spread because the sites are commonly used by the same birds?
- What is the position of the site in the flyways of migratory waterbirds and can any prediction be made with respect to spread of the disease at a larger geographical scale?
- What is the timing of migration for higher risk species occurring at the site?

114. In order to find answers to these questions, it is necessary to locate quickly and analyse ornithological data that might be managed by different organizations and/or individual ornithologists.

115. A draft Rapid Assessment Format for ornithological data in case of an outbreak of HPAI H5N1 is given by Wetlands International & EURING (2006). Its purpose is to give guidance to site owners and site managers to help them prepare for an outbreak of HPAI H5N1 in their wetland area. Since wetland sites vary greatly with respect to size, habitat characteristics, avifauna, human use, and other aspects, the format provided is of a very general nature. Its main purpose is to guide and stimulate site managers to seriously consider possible future events, to prepare for an outbreak of HPAI H5N1, and to develop a strategy in anticipation of the possible spread of the disease to their site.

116. The draft Rapid Assessment Format was tested at four sites in Europe and west Africa. The format lists the following site-related information and attributes which are considered to be fundamental in preparing for an HPAI H5N1 outbreak:

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4 To date, only identified within Europe (Wetlands International & EURING 2006; Veen *et al.* 2007).

1) General information on the site (location, size, ownership);
2) Short description of the general and ecological characteristics of the site (accessibility, habitat characteristics, human use);
3) Occurrence of vulnerable bird species (status, numbers and seasonal presence of higher risk species, species with a high "contact risk with poultry", and endangered species);
4) Places with high concentrations of vulnerable bird species within the site;
5) Local movements of vulnerable bird species to neighbouring sites;
6) Position of site in the flyway and consequences of bird movements for further spread of HPAI H5N1 virus;
7) Human use of the site and any disturbance effects;
8) Existence of poultry farms within a radius of 10 km of the site (although it should be noted that many species of birds have far greater daily ranges than this);
9) Measures to be considered in case of an outbreak; and
10) Data sources.

2.7 References

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3) Recommended ornithological information to be collected during surveillance programmes or field assessment of wild bird mortality events, especially at wetlands

3.1 Recommended information to be collected

117. All birds from which samples are taken should be identified to species. Where clearly distinguishable subspecies or discrete populations exist, as for some geese, this information should also be collected and reported[5]. Age[6] and sex should be recorded wherever possible.

118. Close collaboration with ornithologists in the capture and sampling of live birds not only facilitates identification of birds but also gives the opportunity to collect additional information on the sampled live birds (such as weight, age, sex and condition), which are important to developing a better understanding of viral ecology and epidemiology. Standard protocols exist for the collection of such data through national ringing schemes (details of which are available for Europe, for example, via EURING (www.EURING.org)). Recording individual ring numbers in the reporting spreadsheet provides a means of accessing these data for future analysis.

119. To provide an audit of identification, it is highly desirable that a clear digital photograph is taken of each sampled bird (especially those found dead and/or not identified by ornithologists) and stored at least until confirmation of laboratory tests. In order to facilitate identification of bird species (which can sometime vary in quite minor plumage details, especially at certain times of the year), photographs should be taken according to the guidance given in Section 3.2 below. In the event of positive results, further examination of such photos can provide additional information on the age and sex of the bird, in addition to proving the identity of the species beyond doubt and thus allowing the case to be correctly put into context. To facilitate this, each individual bird should be given a code that is used on the cloacal and oro-pharyngeal swabs taken, and this code should be on a piece of card that is visible in each photograph taken.

120. Especially related to sampling in the vicinity of outbreaks, it is desirable to collect a range of contextual information so as to better understand the viral epidemiology of H5N1 HPAI in wild bird populations. Such information should include:

    i) date of sampling, clear locational and descriptive data about the catching site, ideally GPS coordinates, including habitat description (e.g., lake, river, village pond, fish farm, etc.) and distance to human settlement, agricultural land, and poultry farms; it may also be useful to include details about the season and relate this information to the natural behaviour/cycle of the affected birds, e.g., moulting, pre-migration, during migration, etc.;

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5 Wetlands International's publication *Waterbird Population Estimates* [Wetlands International 2006. *Waterbird Population Estimates - Fourth Edition.* Wetlands International, Wageningen, The Netherlands. 239 pp.] should be used as a source of information on the taxonomy and populations of waterbirds.

6 Waterbirds are aged mainly by the size and shape of their wing feathers (mainly on greater covert and tertial shape - www.bto.org/ringing/ringinfo/resources/topography.pdf) and their tail feathers (juveniles having notched tail feathers).

ii) record of the numbers of each species of other live birds in the sampling area that were not sampled;
iii) if available, records of bird movements (arrivals/departures) that occurred at the sampling site prior to the sampling;
iv) assessment of the numbers of each species of live bird in the sampling area that were not sampled but that were showing signs of ill health; and
v) given that birds of some species (such as Mallards *Anas platyrhynchos*) can occur either as wild birds that are able to move between sites or occur in a feral state, habituated to foods provided by humans, distinguishing between these categories would be useful. Sometimes the presence of unusual plumage patterns, indicating domestication, is useful in this respect.

3.2 Guidance on taking photographs of dead birds for identification purposes

121. The following simple guidance will assist non-specialists in taking photographs, especially of dead birds, that will allow subsequent identification to species. Different bird species are identified by differing characteristics, so it is difficult to provide universal guidance applicable in all situations. However, the following is a minimum standard that should be followed.

122. All wild birds collected for analysis for HPAI should have digital photographs taken as soon as possible after collection. The bird should fully fill the photograph and wherever possible include a ruler or other scale measure.

123. Each photograph should be taken at the highest resolution possible and if the camera has a 'date stamp' feature then this should be enabled so that the image is saved with a time reference – this may help verify the sequence of images taken at a site on a day. Images should be downloaded to a computer as soon as possible and information about location and date added to the file properties.

124. Photographs should be taken of:

- the whole bird, dorsal side, with one wing stretched out and tail spread and visible;
- the head in profile clearly showing the beak;
- close-up photos of the tips of wing feathers, as these can often determine whether the bird is an adult or a juvenile (bird in its first year); and
- ideally photographs of both dorsal and ventral views of the bird, as photos of the upper and under surfaces of the wing and spread tail will facilitate aging and sexing of birds (e.g., Northern Pintail *Anas acuta*);

125. Any ventral photographs should show the legs and feet (since leg colour is often an important species diagnostic). If any rings (metal or plastic) are present on the legs, these should be photographed *in situ* as well as recording ring details. Any conspicuous markings/patterns should also be photographed.

126. At certain times of the year, such as late summer (July - August in the northern hemisphere) many waterbirds, especially ducks and geese, undergo moult and can be especially difficult to identify by non-specialists. At such times clear photographs are especially important to aid identification of (duck) carcasses. The patch of colour on the

open wing (called the "speculum") is often especially useful. The identification of young gulls at any time of the year is also difficult and typically they will also need to be photographed and identified by specialists.

127. Photographs should be retained, linked to an individual specimen, at least until laboratory tests are returned as negative for avian influenza. A unique code or reference number that is the same as the code or reference number of any samples taken from the birds should be visible in each photograph so as to link samples and photographs.

128. Photographs can be used immediately if identification of the species of bird is in any doubt, and for subsequent checking of the identification if necessary.

4) Ornithological expert panels

129. Several Contracting Parties have found it valuable to establish advisory panels involving best available ornithological expertise as a means of responding to the call in Resolution IX.23 to integrate ornithological expertise within government disease response processes. Such panels can provide specialist advice to veterinarians, epidemiologists, and others in response to outbreaks. The following guidance is based on these experiences.

130. Whether a separate panel is established or alternatively that ornithological expertise is integrated into other governmental processes instead will depend on the nature of existing organizational structures. This should be determined nationally. However, ideally any Ornithological Expert Panel (OEP) should be part of the epidemiological team that has the responsibility to investigate HPAI outbreaks, as such integration greatly assists in the identification of achievable scientific objectives.

131. Tables 1 and 2 above list further sources of information and guidance as to how expert specialist advice can be integrated within government responses.

4.1 Composition

132. Ornithological Expert Panels should comprise best available ornithological expertise drawn from both governmental and non-governmental sectors, including ornithological experts from research institutes or universities as appropriate. Staff from national bird ringing centres and national or other relevant waterbird monitoring schemes, where these exist, should be involved in order to facilitate rapid analysis of data and information drawn from relevant databases and other information sources

4.2 Establishment

133. OEPs or other advisory bodies should be established in advance of disease outbreaks as part of forward national contingency planning. There is value to all involved in explicitly establishing the formal relationship between the OEP (or similar) within other government disease response processes and structures.

4.3 Scale and federal states

134. The scale at which advice is sought will depend on how government is structured. If animal disease responses are coordinated within federal states at subnational scales, then typically specialist ornithological advice should be available to decision-makers at that scale.

4.4 Mode of working

135. In order to facilitate the rapid convening of advisory expertise, contingency planning should include means of bringing together relevant experts at short notice in order to provide advice to decision-makers immediately after confirmation of infection outbreaks. Where possible, the experts should be made aware and kept up to date on the epidemiological features of any outbreak involving domestic poultry and the progress of the epidemiological investigations. It should be anticipated that experts will be scattered

and may not be able to assemble physically, thus necessitating the use of teleconferencing or other similar arrangements, which should be planned for.

4.5 Emergency ornithological field assessments

136. In order to assist epidemiological investigation, and to help better to reduce risk of the spread of disease, contingency planning should address the need for emergency field assessments to establish the nature of, and collect information on, populations of wild birds near an outbreak site. These field assessments are usually driven by outbreak specific objectives, but they can include local wild bird movements and the degree of access to domestic poultry. Ornithological advice on additional and specific surveillance is frequently sought following these assessments. One possible format for such evaluations is provided by Wetlands International (2006).

137. Field assessments should be complemented by desk-based rapid ornithological data assessments that seek to interrogate available data sources and thus to inform risk assessments. Even if available data on birds near outbreaks may be limited, they will always assist decision-making to systematically collate relevant information.

4.6 International networking

138. It is very valuable to be able to share risk assessments and ornithological data and evaluations between neighbouring countries or within wider geographic regions. To this end, national OEPs should collaborate together at regional scales to develop collective international assessments and understanding.

4.7 Lessons learnt

139. Following the activation of the OEP in the event of an outbreak, it is essential afterwards to then undertake a formal 'lessons learnt' review to identify any problems or areas of operation where there may be scope for improvement of activity. The outcome of such a review should then be implemented by modifying contingency arrangements (and/or formal Terms of Reference).

4.8 References

Wetlands International 2006. *Urgent preliminary assessment of ornithological data relevant to the spread of Avian Influenza in Europe*. Wetlands International report to DG-Environment, European Commission. 230 pp. Available from http://ec.europa.eu/environment/nature /conservation/wildbirds/birdflue/docs/rep_spread_avian_influenza_report.pdf.

Appendices

Appendix 1. Scientific summary of highly pathogenic avian influenza H5N1: wildlife and conservation considerations

Definition of avian influenza

1. Avian influenza is a highly contagious disease caused by influenza A viruses, affecting many species of birds. Avian influenza is classified according to disease severity into two recognized forms: low pathogenic avian influenza (LPAI) and highly pathogenic avian influenza (HPAI). LPAI viruses are generally of low virulence, while HPAI viruses are highly virulent in most poultry species, resulting in nearly 100% mortality in infected domestic flocks (Center for Infectious Disease Research & Policy 2007). The natural reservoir of LPAI viruses is in wild waterbirds – most commonly in ducks, geese, swans, waders/shorebirds and gulls (Hinshaw & Webster 1982; Webster *et al.* 1992; Stallknecht & Brown 2007).

2. To date, influenza A viruses representing 16 haemagglutinin (HA) and nine neuraminidase (NA) subtypes have been described in wild birds and poultry throughout the world (Rohm *et al.* 1996; Fouchier *et al.* 2005). Viruses belonging to the antigenic subtypes H5 and H7, in contrast to viruses possessing other HA subtypes, may become highly pathogenic after having been transmitted in low pathogenic form from wild birds to poultry and subsequently circulating in poultry populations (Senne *et al.* 1996).

3. Notifiable avian influenza is defined by the World Organization for Animal Health (OIE) as "an infection of poultry caused by any influenza A virus of the H5 or H7 subtypes or by any avian influenza virus with an intravenous pathogenicity index (IVPI) greater than 1.2 (or as an alternative at least 75% mortality)", according to the OIE's Terrestrial Animal Health Code (OIE 2007).

Genesis of highly pathogenic avian influenza viruses

4. In wild waterbirds, LPAI viruses are a natural part of the ecosystem. They have been isolated from over 90 species of wild bird (Stallknecht & Shane 1988, Olsen *et al.* 2006; Lee 2008) and are thought to have existed alongside wild birds for millennia in balanced systems. In their natural hosts, avian influenza viruses infect the gastrointestinal tract and are shed through the cloaca; they generally do not cause disease although some behavioural anomalies have been reported, such as reduced migratory and foraging performance in Bewick's Swans *Cygnus columbianus bewickii* (van Gils *et al.* 2007). Instead, the viruses remain in evolutionary stasis as indicated by low genetic mutation rates (Gorman *et al.* 1992; Taubenberger *et al.* 2005).

5. When LPAI viruses are transmitted to vulnerable poultry species, only mild symptoms such as a transient decline in egg production or reduction in weight gain (Capua & Mutinelli 2001) are induced. However, where a dense poultry environment supports several cycles of infection, the viruses may mutate, adapting to their new hosts, and for the H5 and H7 subtypes these mutations can lead to the generation of a highly pathogenic form. Thus, HPAI viruses are essentially products of intensively farmed poultry, and their incidence has increased dramatically with the greatly enhanced volume of poultry production around the

world (GRAIN 2006; Greger 2006). In the first few years of the 21st century the incidence of HPAI outbreaks has already exceeded the total number of outbreaks recorded for the entire 20th century (Greger 2006). In general, they should be viewed as something artificial, made possible by intensive poultry production techniques.

6. After an HPAI virus has arisen in poultry, it has the potential both to re-infect wild birds and to cause disease in various mammalian taxa. If influenza A viruses adapt inside these new hosts to become highly transmissible, there could be devastating consequences, such as the human influenza pandemics of the 20th century (Kilbourne 2006). The conditions necessary for cross-infection are provided by agricultural practices that bring together humans, poultry and other species in high densities in areas where there is also the potential for viral transmission from infected poultry, poultry products and waste to wild birds, humans and other mammals in shared wetlands and in 'wet' (i.e., live animal) markets (Shortridge 1977; Shortridge *et al.* 1977).

Highly pathogenic avian influenza H5N1 of Asian lineage (HPAI H5N1)

7. HPAI H5N1 of Asian lineage has infected domestic, captive and wild birds in more than 60 countries in Asia, Europe and Africa (OIE 2008). By November 2005, i.e., before widespread occurrence in western Eurasia and Africa, over 200 million domestic birds had died from the disease or been slaughtered in attempts to control its spread; the economies of the worst affected countries in southeast Asia have suffered greatly, with lost revenue estimated at over $10 billion (Diouf 2005), and there have been serious human health consequences. By October 2008, the World Health Organization had confirmed more than 380 human cases, over 60% of those fatal (World Health Organization 2008).

8. Sporadic deaths in wild birds have been reported since 2002 and the first outbreak involving a large number of wild birds was reported in May 2005, in Qinghai province, China (Chen *et al.* 2005; Liu *et al.* 2005). Between 2002 and the present, the virus has infected a wide range of wild bird species (Olsen *et al.* 2006; USGS National Wildlife Health Center 2008; Lee 2008), but which species are important in H5N1 HPAI movement and whether the virus will become endemic and prevalent in wild bird populations is still unknown (Brown *et al.* 2006).

9. The virus has also infected a limited number of domestic, captive and wild mammals, including captive Tigers *Panthera tigris* and Leopards *Panthera pardus* and domestic pigs in southeast Asia, as well as domestic cats and a wild Stone Marten *Martes foina* in Germany. These cases were the result of 'spillover' infection from birds. There is no known reservoir of HPAI H5N1 virus in mammals, and there remains no sound evidence that the virus can be readily transmitted from mammal to mammal.

Emergence of HPAI H5N1 in poultry in southeast Asia (1996–2005)

10. HPAI H5N1 first received widespread recognition following a 1997 outbreak in poultry in Hong Kong, PR China with subsequent spread of the virus to humans. During that outbreak, 18 human cases were recognized and six patients died. The outbreak ended when all domestic chickens held by wholesale facilities and vendors in Hong Kong were slaughtered (Snacken 1999). A precursor to the 1997 H5N1 strain was identified in Guangdong, China, where it caused deaths in domestic geese in 1996 (Webster *et al.* 2006).

11. Between 1997 and 2002, different reassortments (known as genotypes) of the virus emerged in domestic goose and duck populations, which contained the same H5 HA gene but had different internal genes (Guan *et al.* 2002; Webster *et al.* 2006).

12. In 2002, a single genotype emerged in Hong Kong, PR China and killed captive and wild waterbirds in nature parks there. This genotype spread to humans in Hong Kong in February 2002 (infecting two, killing one) and was the precursor to the Z genotype that later became dominant (Sturm-Ramirez *et al.* 2004; Ellis *et al.* 2004).

13. Between 2003 and 2005, the Z genotype spread in an unprecedented fashion across southeast Asia, affecting domestic poultry in Vietnam, Thailand, Indonesia, Cambodia, Laos, the Republic of Korea, Japan, China and Malaysia. Later analysis showed that the H5N1 viruses that caused outbreaks in Japan and the Republic of Korea were genetically different from those in other countries (the V genotype) (Mase *et al.* 2005; Li *et al.* 2004; Webster *et al.* 2006).

14. In April 2005, the first major outbreak in wild birds was reported. Some 6,345 wild birds were reported dead at Qinghai Lake in central China. Species affected included Great Black-headed Gull *Larus ichthyaetus*, Bar-headed Goose *Anser indicus*, Brown-headed Gull *Larus brunnicephalus*, Great Cormorant *Phalacrocorax carbo* and Ruddy Shelduck *Tadorna ferruginea* (Chen *et al.* 2005; Liu *et al.* 2005).

Geographical spread of HPAI H5N1 out of southeast Asia (2005 – 2006)

15. In July 2005, Russia reported its first outbreaks; domestic flocks were affected in six regions of western Siberia and dead wild birds were reported in the vicinities of some of these outbreaks. Kazakhstan reported its first outbreak in August 2005 in domestic birds. In the same month, 89 wild birds described as migratory species were reported infected at two lakes in Mongolia.

16. Europe reported its first outbreaks in October 2005 when infection was detected in domestic birds in Romania and Turkey. In the same month, Romania reported sporadic cases in wild birds as did Croatia and European parts of Russia. In November, the virus spread to domestic birds in the Ukraine, and the Middle East reported its first case: a captive flamingo in Kuwait. During December, two outbreaks were reported in European Russia in wild swans (species unreported) in regions near the Caspian Sea.

17. In the first half of 2006, the spread of HPAI H5N1 continued across Europe (Sabirovic *et al.* 2006; Hesterberg *et al.* 2007; Hesterberg *et al.* in press) and the Middle East and into Africa. Between January and May, infection was reported in 24 European countries with the majority of cases occurring in February and March in wild birds. During the same period, outbreaks were reported across central Asia and the Middle East, affecting domestic birds in Azerbaijan, India, Bangladesh, Pakistan, Iran and Iraq, with Azerbaijan also reporting infected wild birds. The first reported outbreak in Africa occurred in January in poultry in Nigeria, and by the end of April, eight other African nations had reported outbreaks: Burkina Faso, Cameroon, Djibouti, Egypt, Ghana, the Ivory Coast, Niger and Sudan (OIE 2008).

18. By May 2006, reports of outbreaks in Europe, the Middle East and Africa had for the most part decreased in frequency. Small numbers of cases of infection were reported in

Hungary, Spain and the Ukraine in June, Pakistan and Russia in July, and one case was identified in a captive swan in Germany in August. Egypt was exceptional, continuously reporting outbreaks throughout 2006. It is also considered likely that outbreaks continued in poultry in Nigeria (UN System Influenza Coordinator & World Bank 2007).

19. Throughout the time HPAI H5N1 was spreading across central Asia, Europe, the Middle East and Africa, it maintained a stronghold in poultry in southeast Asia. In 2006, outbreaks were reported in Cambodia, PR China including Hong Kong, Indonesia, the Republic of Korea, Laos, Malaysia, Myanmar, Thailand and Vietnam (OIE 2008).

Period following the geographic spread westward (2007 – October 2008)

20. Compared with 54 countries reporting 1,470 outbreaks to the OIE in 2006, 30 countries reported 638 outbreaks in 2007 (OIE 2008). In 2007, six European countries (Poland, Hungary, Germany, the United Kingdom, Romania and the Czech Republic) reported sporadic and relatively isolated outbreaks in poultry that were quickly controlled. Outbreaks in domestic birds were also reported in European parts of Russia and in Turkey. Infected wild birds were reported in Germany, France, the United Kingdom and the Czech Republic, and birds at a rehabilitation centre were affected in Poland. In the Middle East and central Asia, poultry outbreaks occurred throughout 2007. Some 350 outbreaks were reported in Egypt and Bangladesh alone. Poultry (and in some cases captive birds) were also affected in India, Kuwait, Saudi Arabia, Pakistan, Afghanistan and Israel with most outbreaks occurring between February and April, and again between October and December. In Africa, HPAI H5N1 was reported in domestic birds in Togo, Ghana and Benin and is considered to have become endemic in Nigeria (OIE 2008; UN System Influenza Coordinator & World Bank 2007). Again, as in 2006, poultry outbreaks continued across southeast Asia. Sporadic cases in wild birds were reported in Japan and Hong Kong, PR China. By the end of 2007, the virus was considered to be endemic in poultry in Egypt, Indonesia and Nigeria, and possibly endemic in Bangladesh and China (UN System Influenza Coordinator & World Bank 2007).

21. Until the end of October 2008, no new countries had reported outbreaks. Outbreaks in domestic birds were reported in Bangladesh, China, Egypt, India, Indonesia, Nigeria, Pakistan, the Republic of Korea, Russia, Turkey and Vietnam between January and July, with outbreaks in Bangladesh, Germany, Laos, Togo and Vietnam in September and October. Infected wild birds were reported in four countries: Mute Swans *Cygnus olor* and a Canada Goose *Branta canadensis* in the United Kingdom in January and February; sick and dead swans in three areas of Japan in April and May; one apparently asymptomatic Pochard *Aythya ferina* in Switzerland in March; and one dead House Crow *Corvus splendens* in Hong Kong, PR China in October. Bangladesh reported its first human case of H5N1 infection in March. China, Egypt, Indonesia and Vietnam also reported human cases in 2008.

Significant outbreaks of HPAI H5N1 in wild birds

22. Prior to HPAI H5N1, reports of HPAI in wild birds were very rare. The broad geographical scale and extent of the disease in wild birds is both extraordinary and unprecedented. The following table summarises the known significant outbreaks of HPAI H5N1 in wild birds.

Table 3. Significant known outbreaks of highly pathogenic avian influenza H5N1 in wild birds*

Year	Month(s)	Location(s)	Description of affected birds
2005	April	Qinghai Lake in central China	6345 waterbirds, the majority of which were Great Black-headed Gulls *Larus ichthyaetus*, Bar-headed Geese *Anser indicus* and Brown-headed Gulls *Larus brunnicephalus*
	August	Lake Erhel & Lake Khunt in Mongolia	89 waterbirds including ducks, geese and swans
	October – November	Romania & Croatia	Over 180 waterbirds, mainly swans
2006	January	Coastal area in the vicinity of Baku, Azerbaijan	Unspecified number of birds reported to the OIE as "various migratory birds"
	January – May	23 countries in Europe including Turkey and European Russia	Most cases occurred in ducks, geese and swans but a wide variety of species was infected including other waterbirds and raptors
	February	Rasht, Iran	153 wild swans
	May	Multiple locations in Qinghai province, China	Over 900, mainly waterbirds, and mostly Bar-headed Geese *Anser indicus*
	May	Naqu, Tibet	Over 2,300 birds – species composition unclear but 300 infected Bar-headed Geese *Anser indicus* were reported
	June	Lake Khunt in Mongolia	Twelve waterbirds including swans, geese and gulls
2007	June	Germany, France and the Czech Republic	Over 290, mainly waterbirds, found mostly in Germany

* Data sources include OIE disease information reports and the German Friedrich-Loeffler Institute epidemiological bulletins – dates, locations and numbers may differ slightly in other sources.

23. Numerous species of wild birds, especially waterbirds, are susceptible to infection by the HPAI H5N1 virus. Close contact between poultry and wild birds can lead to cross-infection, from poultry to wild birds and from wild birds to poultry. Additionally, species that live in and around poultry farms and human habitations may serve as "bridge species" that could potentially transmit the virus between poultry and wild birds either by direct contact between wild birds and poultry kept outside or by indirect contact with contaminated materials. While there is no sound evidence that wild birds have carried the virus long distances on migration (Feare & Yasué 2006), analysis of genetic sequences and other largely indirect evidence suggests that wild birds are likely to have contributed to the spread (Chen *et al.* 2006; Keawcharoen *et al.* 2008; Kilpatrick *et al.* 2006; Hesterberg *et al.* 2007; Weber & Stilianakis 2007). The relative importance of different modes of infection transfer, however, is unclear in the present state of knowledge.

24. Poor planning in response to development pressures has led to the increasing loss or degradation of wild ecosystems, which are the natural habitats for wild birds. This has resulted in closer contact between wild populations, domesticated birds such as chickens, ducks, geese, and other domestic fowl, and humans and has thus provided greater opportunities for the spread of HPAI H5N1 between wild and domestic birds, and thence to humans. The interplay between agriculture, animal (domestic and wild) health, human health, ecosystem health, and socio-cultural factors has been important in the emergence and spread of the virus.

Avian influenza and wetlands

25. Given the ecology of the natural hosts of LPAI viruses, it is unsurprising that wetlands play a major role in the natural epidemiology of avian influenza. As with many other viruses, avian influenza virions survive longer in colder water (Lu *et al.* 2003; Stallknecht *et al.* 1990), and the virus is strongly suggested to survive over winter in frozen lakes in Arctic and sub-Arctic breeding areas. Thus, as well as the waterbird hosts, these wetlands are probably permanent reservoirs of LPAI virus (Rogers *et al.* 2004; Smith *et al.* 2004), (re-)infecting waterbirds arriving from southerly areas to breed (shown in Siberia by Okazaki *et al.* 2000 and Alaska by Ito *et al.* 1995). Indeed, in some wetlands used as staging grounds by large numbers of migratory ducks, avian influenza viral particles can be readily isolated from lake water (Hinshaw *et al.* 1980).

26. An agricultural practice that provides ideal conditions for cross-infection and thus genetic change is used on some fish-farms in Asia: battery cages of poultry are placed directly over troughs in pig-pens, which in turn are positioned over fish farms. The poultry waste feeds the pigs, the pig waste is either eaten by the fish or acts as a fertiliser for aquatic fish food, and the pond water is sometimes recycled as drinking water for the pigs and poultry (Greger 2006). These kinds of agricultural practices afford avian influenza viruses, which are spread via the faecal-oral route, a perfect opportunity to cycle through a mammalian species, accumulating the mutations necessary to adapt to mammalian hosts. Thus, as the use of such practices increases, so does the likelihood that new influenza strains infectious to and transmissible between humans will emerge (Culliton 1990; Greger 2006).

27. As well as providing conditions for virus mutation and generation, agricultural practices, particularly those used on wetlands, can enhance the ability of a virus to spread. The role of Asian domestic ducks in the epidemiology of HPAI H5N1 has been closely researched and found to be central not only to the genesis of the virus (Hulse-Post *et al.* 2005; Sims 2007), but also to its spread and the maintenance of infection in several Asian countries (Shortridge & Melville 2006). Typically this has involved flocks of domestic ducks used for 'cleaning' rice paddies of waste grain and various pests, during which they can potentially have contact with wild ducks using the same wetlands. Detailed research (Gilbert *et al.* 2006; Songserm *et al.* 2006) in Thailand has demonstrated a strong association between the HPAI H5N1 virus and abundance of free-grazing ducks. Gilbert *et al.* (2006) concluded that in Thailand "wetlands used for double-crop rice production, where free-grazing duck feed year round in rice paddies, appear to be a critical factor in HPAI persistence and spread".

Wildlife conservation implications

28. Prior to HPAI H5N1, reports of HPAI in wild birds were very rare. The broad geographical scale and extent of the disease in wild birds is both extraordinary and unprecedented, and the conservation impacts of HPAI H5N1 have been significant.

29. It is estimated that between 5-10% of the world population of Bar-headed Goose *Anser indicus* died at Lake Qinghai, China, in spring 2005 (Chen *et al.* 2005; Liu *et al.* 2005). At least two globally threatened species have been affected: Black-necked Crane *Grus nigricollis* in China and Red-breasted Goose *Branta ruficollis* in Greece. Approximately 90% of the world population of Red-breasted Goose is confined to just five roost sites in Romania and Bulgaria, countries that have both reported outbreaks, as also have Russia and Ukraine where they also over-winter (BirdLife International 2007).

30. However, the total number of wild birds known to have been affected has been small in contrast to the number of domestic birds affected, and many more wild birds die of more common avian diseases each year. Perhaps a greater threat than direct mortality has been the development of public fear about waterbirds resulting in misguided attempts to control the disease by disturbing or destroying wild birds and their habitats. Such responses are often encouraged by exaggerated or misleading messages in the media.

31. Currently, wildlife health problems are being created or exacerbated by unsustainable activities such as habitat loss or degradation, which facilitates closer contact between domestic and wild animals. Many advocate that to reduce risk of avian influenza and other bird diseases, there is a need to move to markedly more sustainable systems of agriculture with significantly lower intensity systems of poultry production. These need to be more biosecure, separated from wild waterbirds and their natural wetland habitats, resulting in far fewer opportunities for viral cross-infection and thus pathogenetic amplification (Greger 2006). There are major animal and human health consequences (in terms of the impact on economies, food security, and potential implications of a human influenza pandemic) of not strategically addressing these issues. However, to deliver such an objective in a world with an ever-growing human population, and with issues of food-security in many developing countries, will be a major policy challenge.

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Appendix 2. Scientific Task Force on Avian Influenza and Wild Birds

1. The **Scientific Task Force on Avian Influenza and Wild Birds** was established in 2005 by the UNEP Convention on Migratory Species (CMS), in close cooperation with the Agreement on the Conservation of African Eurasian Migratory Waterbirds (AEWA). It comprises 14 members and observers, including UN bodies, multilateral environmental agreements (including the Ramsar Convention), and specialist intergovernmental and non-governmental organizations. Since August 2007 the CMS Secretariat and FAO have provided joint coordination for the Task Force.

2. The Task Force aims to obtain the best scientific advice on the conservation impact of the spread of HPAI H5N1, including assessing the potential role of migratory birds as vectors of the virus. It has issued advice on the root causes of the spread of this disease and has promoted the development of international 'early warning' systems. The Task Force promotes objective information on the role of wild birds as vectors of HPAI H5N1 and tries to avoid overreaction by decision/policy makers that could be detrimental to the conservation of waterbird species and their habitats. The members of the Task Force work through teleconferences, e-mail contact, and meetings.

3. The last Task Force meeting, an international workshop on 'Practical Lessons Learned' (Aviemore, Scotland, June 2007), concluded that future outbreaks need to be tackled quickly, involving wild bird experts as well as veterinarians and other specialists. The meeting considered that whilst wild birds are affected by the virus, domestic birds, especially the poultry industry and trade, hold the key to limiting future international spread. Furthermore, there is the continuing need to further develop national interministerial capacities within governments, and interdisciplinary collaborations elsewhere, to respond to the challenges posed by HPAI H5N1.

4. The Task Force also operates a unique web-based platform on Avian Influenza, Wildlife and the Environment (www.aiweb.info), through which information exchange and expert communication on current and emerging topics relating to HPAI H5N1, migratory birds, and the environment is facilitated further.

Contacts and further information:

Francisco Rilla
Information Officer

UNEP/CMS Secretariat
UN Campus
Hermann-Ehlers-Str. 10
53113 Bonn, Germany

Tel: +49 228 815 24 60
Fax: +49 228 81524 49
e-mail: frilla@cms.int

Scott Newman
International Wildlife Coordinator for Avian Influenza

UN Food & Agriculture Organization
Infectious Disease Group/ EMPRES
Viale delle Terme di Caracalla
Rome, Italy 00100

Tel: +39 06 570 53068
Fax: +39 06 570 53023
e-mail: scott.newman@fao.org

Appendix 3. Terminology[7]

Care must be taken to avoid confusion when describing and discussing avian influenza. The terms: avian influenza, avian influenza virus, human influenza, highly pathogenic avian influenza, pandemic influenza, and H5N1 cannot be used interchangeably. The following table lists commonly used avian influenza terms and provides definitions and usage guidelines.

Table 4. Definitions and usage guidelines for a selection of terms commonly used when discussing avian influenza

Term	Acronym	Definition and usage
Avian flu*		Used colloquially and by the media, and often used wrongly, to refer to HPAI in poultry and/or humans – because its use can cause great confusion, it is better to avoid it, even when referring to poultry or other species of birds.
Avian influenza*	AI	A disease of birds caused by an influenza A virus – it is **not** a virus. Only use the term "avian influenza" to refer to the **disease** in poultry or other bird species – and remember that "avian influenza" can refer to either low pathogenic or highly pathogenic forms of the disease (LPAI or HPAI). Infection does not necessarily produce clinical disease.
Avian influenza virus	AIV	The aetiological (causative) agent of avian influenza.
Bird flu*		See Avian flu.
Enzootic/endemic		Prevalent among or present constantly in a population in a specific geographic area.
Genotype		Specific genetic composition of a virus – each subtype of AIV will have multiple genotypes. Genotyping AIVs aids epidemiological investigations.
Hemagglutinin	HA	Surface antigen on the influenza virus. Together with the neuraminidase (NA) antigen it defines the antigenic phenotype of the virus, which in turn classifies influenza A viruses into subtypes.
Highly pathogenic avian influenza	HPAI	A severe disease in poultry and some other birds; has been associated with some H5 and H7 viruses, though not all H5 and H7 viruses are highly pathogenic.
Low pathogenic avian influenza	LPAI	See avian influenza.

7 *Source:* Lubroth, J. & Roeder, P. 2007. *FAO AIDE NEWS. Situation Update* 45: 4-5. Emergency Center for Transboundary Animal Diseases, FAO.

Term	Acronym	Definition and usage
Neuraminidase	NA	Surface antigen on the influenza virus. Together with the hemagglutinin (HA) antigen, it defines the antigenic phenotype of the virus, which in turn classifies influenza A viruses into subtypes.
Pathogenic		Causing disease or capable of doing so.
Poultry		Term referring to domestic birds bred for meat, eggs, feathers, etc., including chickens, turkeys, ducks, geese, quail, etc.
Prevalence		Proportion of individuals within a given population with disease at a given time.
Subtype		A classification of influenza A virus based on the antigenic phenotype, which is determined by the HA and NA antigens present on the virus. Subtype examples include H5N1, H5N2, H7N3, H13N9.
Virulence		Ability of an infectious organizm to produce disease (similar to pathogenicity but more a factor of the virus than of the host response).
Waterbird		Species of birds that are ecologically dependent on wetlands for at least part of their annual cycle including, e.g., wildfowl, waders, gulls, herons, grebes, auks, etc.

* **Never** use the terms "bird flu", "avian flu" or "avian influenza" to refer to human disease, even when it is a question of influenza in humans caused by infection from HPAI – the correct term to use, even though it is lengthy, is "influenza in humans caused by a virus of avian origin".