Ducks and the risk of avian influenza in Portugal

Patos e o risco de influenza aviária em Portugal

David Rodrigues[1], Maria Ester Figueiredo[2], António Fabião[2] & Vitor Encarnação[3]

The outbreak of highly pathogenic avian influenza of the H5N1 virus subtype in Western European countries induced the fear that it could reach Portugal through wild bird migration. Ducks, geese and swans are some of the bird groups with higher prevalence of influenza virus that might be vectors of virus dissemination, considering the existing studies on low pathogenic subtypes that are common in nature (Olsen *et al.* 2006), and also occur in Portugal (D. Rodrigues *et al.*, unpublished data). Although swans do not occur frequently in Portugal and geese are mostly restricted to Tagus River Estuary Nature Reserve (e.g. Farinha & Costa 1999), ducks are common in Portugal and mostly concentrated on wetlands near the coast (Costa & Guedes 1997), and wintering *Aythya* duck species are much less numerous than wintering *Anas* species (e.g. Costa & Guedes 1997). The Portuguese total wintering duck population (Costa & Guedes 1997) is relatively small when compared to the total European population (Scott & Rose 1996), probably due to the location of the country on the South-West limit of the distribution for most of the species (Scott & Rose 1996). However, given the recent occurrence of outbreaks of highly pathogenic avian influenza of the H5N1 subtype in France, Germany, Scotland, Denmark, Sweden and Poland (OIE 2006), there is a risk that outbreaks may also occur in Portugal.

In this paper, we aim to discuss the possibility of avian influenza occurrence in Portugal, under the assumptions that outbreaks will persist, will occur new ones or the virus will become endemic on the above mentioned countries and that ducks will be vectors of the virus.

We reviewed all Portuguese recoveries/recaptures/resightings of ducks marked in foreign countries, available at the database of the Portuguese Ringing Station "Central Nacional de Anilhagem" (ICN, Lisbon) or published (Tait 1955, 1960, 1961, 1962, Freire 1969, Oliveira 1974, Carvalho 1975, Ferreira 1980, Candeias & Castro 1982, Silva & Castro 1991, 1992). We also analysed and summarised all foreign recoveries/recaptures/resightings of ducks ringed and nasal marked in Portugal by us (Rodrigues *et al.* 2001), from June 1993 until March 2006, or ringed by others before. Information compiled for each record included (1) countries to or from where movements occurred, (2) their geographical coordinates, (3) spatial correlation with countries where outbreaks occurred, and (4) speed of movements, measured by the time and the distance between marking and recovery/recapture/resighting. Maps of international movements were produced for Teal *Anas crecca*, the more abundant wintering migratory duck species in Portugal (Costa & Guedes 1997), and for Tufted duck *Aythya fuligula* and Pochard *Aythya ferina*, the 2 most frequent species of ducks found dead during the recent outbreaks in Western Europe (OIE 2006).

We also reviewed monthly and weekly counts of ducks available for Portugal (Encarnação 1991, Costa & Guedes 1994, 1997, Fradoca & Rodrigues 1998, Figueiredo 2003) to estimate dates of arrival to Portugal of migratory ducks and concentration of ducks in main areas of occurrence (as an indicator of potential risk of virus transmission within ducks). For the summer period we used weekly point count data (Poysa & Nummi 1992)

[1]Departamento Florestal – Escola Superior Agrária de Coimbra, Bencanta 3040-316 Coimbra. e-mail: drodrigues@esac.pt / [2]Departamento de Engenharia Florestal – Instituto Superior de Agronomia, Tapada da Ajuda, 1349-017 Lisboa / [3]Central Nacional de Anilhagem, Instituto da Conservação da Natureza, Rua de Santa Marta, 55 - 3º, 1150-294 Lisboa

Table 1. Number of ducks marked in Portugal and resulting international movements (from 1993 until March 2006), and movements to Portugal from ducks marked abroad. / ***Tabela 1.*** *Número de patos marcados em Portugal e movimentos internacionais resultantes (de 1993 a Março de 2006), e movimentos para Portugal de patos marcados no estrangeiro.*

Species	Ducks marked in Portugal		Movements to Portugal from foreign marked birds
	Total number	Number of International movements	
Pintail *Anas acuta*	14	3	1
Shoveler *Anas clypeata*	54	14	18
Teal *Anas crecca*	2287	154	40
Green-winged Teal *Anas carolinensis*	2	0	0
Wigeon *Anas penelope*	287	19	1
Mallard *Anas platyrhynchos*	7864	141	40
Garganey *Anas querquedula*	4	0	0
Gadwall *Anas strepera*	23	2	7
Ring-necked Duck *Aythya collaris*	1	0	0
Pochard *Aythya ferina*	6	1	19
Tufted-duck *Aythya fuligula*	67	13	7
Total	10609	347	133

collected at the "Pateira", a pound with less than 8 hectares of water surface area, at S. Jacinto Dunes Nature Reserve (40º 41'N, 08º 44'W).

Before 1993 there was no regular capture and ringing of ducks in Portugal and on the Portuguese ringing database there was only a single international recovery of a Portuguese marked Teal and none of the other species. Table 1 summarises the number of movements to Portugal from ducks marked in foreign countries and, from June 1993 to March 2006, the total number of ducks marked in Portugal and the resulting number of international movements. In the case of Teal we should add to the values mentioned in table 1 the recovery in Portugal of an Icelandic ringed bird, two recoveries of teals ringed in the Netherlands (Lebret 1947), and five more recoveries also from the Netherlands (Wolff 1966), which were not included in the table due to lack of detailed information.

Migratory ducks wintering in Portugal mostly use the European Atlantic Flyway (Figure 1), with the exception of Pochard which may also use the Central European migratory route (Figure 2, note that 10 movements of Pochard resulted from birds ringed in Spain in capture sites with similar coordinates).

Migratory ducks start to arrive in high numbers during October, but some tens of teals arrive at S. Jacinto as early as late July and August (Figueiredo 2003), while the other duck species usually start to arrive during September (Fradoca & Rodrigues 1998). The exception is the Tufted Duck, which usually arrives only in late October or November (e.g. Costa & Guedes 1997). The Mallard *Anas platyrhynchos* is basically resident (Rodrigues *et al.* 2000), and start to concentrate in high numbers in July, reaching the highest values in August, just before the start of duck hunting season. At S. Jacinto, Mallard maximum counts in August vary within years, usually between 1600 and 2200 birds (Rodrigues 2001), but can reach more than 3000 birds after favourable breeding season conditions (D. Rodrigues unpublished data).

The fastest movement recorded was from a Teal that flew 864 km in 2 days, from S. Jacinto to France. Clausen *et al.* (2002) also mentioned a Teal that covered 1285 km in one day, from Denmark to France.

Most duck species use the European Atlantic Flyway to migrate to Portugal, passing through the countries where H5N1 outbreaks were detected. However, some teals changed flyway after the breeding period and a representative proportion of wintering pochards seem to use the Central European Flyway, as observed in Spain (Saez-Royuela & Martinez 1985), but also crossing

Figure 1. International movements of teals *Anas crecca* wintering in Portugal. / ***Figura 1.*** *Movimentos internacionais de marrequinhas* Anas crecca *invernantes em Portugal.*

countries where were recorded outbreaks of avian influenza. In addition, movements from ducks escaping from extremely cold weather, such as cold spells (Ridgill & Fox 1990), may favour the arrival to Iberia of ducks from the far East, which normally would spent the winter in the Eastern and/or Central Mediterranean (e.g. Guillemain *et al.* 2005).

The epidemiology of the highly pathogenic avian influenza of the H5N1 subtype is not yet well known and we even do not know if the duck species that were more frequently found dead were the vectors of virus dissemination or just acted like sentinels (Olsen *et al.* 2006). Therefore, the available information is not enough to determine if the outbreaks that occurred in Western Europe will persist, if there will be new outbreaks or if the virus will become endemic. In the case of future virus outbreaks in the Atlantic European Flyway and of a significant role of ducks as vectors of its dissemination, avian influenza will probably have the first recorded outbreak in Portugal during the following autumn and/or winter, especially if there will be a cold spell before the end of December. Cold spells occurring after early January should not result in a large increase of numbers of migratory ducks in Iberia, because the photoperiod is increasing, which suggests that ducks start migrating North and not South (e.g. Bairlein 2002), unless most other European wetlands would freeze, including those of Southern France (e.g. Tamisier & Dehorter 1999). Cold spells should favour H5N1 dissemination out of duck movements, because H5N1 virus increase it's survival in the environment with a decrease in temperature (Olsen *et al.* 2006), and because ducks become stressed by shortage of food resources thereby increasing their movements. The potential risk of occurrence is also high during late July and August, since the high density of Mallards that usually occur during that period will favour the disease dissemination if

Figure 2. International movements of Tufted Duck *Aythya fuligula* (circles) and Pochard *Aythya ferina* (triangles) wintering in Portugal. / ***Figura 2.*** *Movimentos internacionais de Zarro negrinha* Aythya fuligula *(circulos) e Zarro comum* Aythya ferina *(triângulos) invernantes em Portugal.*

infected birds reach Portugal, and also because ducks moulting primaries also should be more vulnerable due to their usually low body condition.

As already mentioned, teals may cover long distances in few days, potentially acting as efficient virus transporters, especially if they do not became affected by the virus, soon after the infection. This seems to be the case since few *Anas* species were found dead during the outbreaks and recent laboratory studies showed that several duck species are not affected by the virus (e.g. Brown *et al.* 2006).

The past and present avian influenza situation shows many gaps on our knowledge of duck ecology, migration and population dynamics in Europe, and put a bigger emphasis on what is needed for the sustainable management of these populations (see Elmberg *et al.* 2006). More monitoring and research are fundamental for a better prediction of scenarios of avian influenza dissemination, especially for a sustainable management of duck populations.

Acknowledgements: The research was funded by Junta Nacional de Investigação Científica e Tecnológica (JNICT, Lisbon), through a doctoral scholarship to D. Rodrigues (Programs CIENCIA and PRAXIS XXI), by Project STRD/AGR/0038 (JNICT, Lisbon), Project PAMAF 4031 (Instituto Nacional de Investigação Agrária, Lisbon), by Fundação para a Ciência e Tecnologia (projects POCTI/PNAT/AGR/15032/1999 and POCTI/AGG/49475/2002), and the research line Freshwater Resources and Wetland Management of Centro de Estudos Florestais (Instituto Superior de Agronomia, Lisbon). The field assistance of P. Tenreiro, C. Fradoca and R. Vaz are gratefully acknowledged.

RESUMO

Discutimos a probabilidade de ocorrência da influenza aviária ou gripe das aves (H5N1) em Portugal, pela compilação e análise dos movimentos internacionais

efectuados pelos patos que invernam em Portugal e pela revisão das contagens de patos disponíveis para Portugal ao longo do ano. Os patos migradores utilizam a Rota Migratória Atlântica Europeia e chegam aos locais de invernada em Portugal, passando pelos países da Europa Ocidental onde se verificaram surtos de H5N1 durante o princípio de 2006. Se os surtos se mantiverem, vierem a ocorrer novos surtos ou se o vírus vier a tornar-se endémico desta Rota Migratória, a gripe das aves muito provavelmente chegará a Portugal durante o Outono ou Inverno seguinte mas também poderá chegar logo no final de Julho ou Agosto, assumindo os patos como vectores importantes e não afectados pelo vírus, logo a seguir à infecção.

REFERENCES

Bairlein, F. 2002. How do birds migrate? The behavioural physiology of migration and orientation: pp. 31-37 in C.V. Wernham, M.P. Toms, J.H. Marchant, J.A. Clark, G.M. Siriwardena & S.R. Baillie (eds.). *The Migration Atlas: movements of the birds of Britain and Ireland*. T. & A.D. Poyser, London.

Brown, J.D., D.E. Stallknecht, J.R. Beck, D.L. Suarez & D.E. Swayne 2006. Susceptibility of North American Ducks and Gulls to H5N1 Highly Pathogenic Avian Influenza Viruses. *Emerging Infectious Diseases* 12: 1663-1670.

Candeias, D.R. & M.F.C. Castro 1982. *Aves com anilhas estrangeiras capturadas em Portugal até final de 1981*. CEMPA, Secretaria de Estado do Ambiente, Lisboa,.

Carvalho, M.B. 1975. *Anilhas recuperadas em Portugal Continental e Insular entre 1968/72 de aves anilhadas na Europa*. CEMPA, Secretaria de Estado do Ambiente, Lisboa.

Clausen, P., B.A. Nolet, A.D. Fox & M. Klaassen 2002. Long-distance endozoochorous dispersal of submerged macrophyte seeds by migratory waterbirds in northern Europe - a critical review of possibilities and limitations. *Acta Oecologica* 23: 191–203.

Costa, L.T. & R.S. Guedes 1994. *Contagens de Anatídeos Invernantes em Portugal - 1992/93*. Estudos de Biologia e Conservação da Natureza, 14. Instituto de Conservação da Natureza, Lisboa

Costa, L.T. & R.S. Guedes 1997. *Contagens de Anatídeos Invernantes em Portugal Continental. Invernos de 1993/94 a 1995/96*. Estudos de Biologia e Conservação da Natureza, 20. Instituto de Conservação da Natureza, Lisboa.

Elmberg, J., P. Nummi, H. Pöysä, K. Sjöberg, G. Gunnarsson, P. Clausen, M. Guillemain, D. Rodrigues & V. Väänänen 2006. The scientific basis for a new and sustainable management of migratory European ducks. *Wildlife Biology* 12: 121-127.

Encarnação, V.M.F. 1991. *Reserva Natural das Dunas de S. Jacinto – Contagem de Aves Aquáticas*. Colecção de Estudos, 7. Serviço Nacional de Parques Reservas e Conservação da Natureza, Lisboa.

Farinha, J.C. & H. Costa 1999. *Aves Aquáticas de Portugal. Guia de Campo*. Instituto de Conservação da Natureza, Lisboa.

Ferreira, A.C. 1980. Recapturas de aves anilhadas no estrangeiro (1972-74). *Cyanopica* 2: 57-94.

Figueiredo, M. 2003. *Ecologia e Ordenamento da Marrequinha (*Anas crecca *L.) no Centro de Portugal*. Master Thesis. Faculdade de Ciências e Tecnologia, Universidade de Coimbra, Portugal.

Fradoca, C.M.S. & Rodrigues, D.J.C. 1998. Importância da R.N. das Dunas de S. Jacinto para os Anatídeos Migradores: pp. 98-100 in L.T. Costa, H. Costa, M. Araújo & M.A. Silva (eds.). *Actas do Simpósio sobre Aves Migradoras na Península Ibérica*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.

Freire, O. 1969. Aves anilhadas no estrangeiro e capturadas em Portugal (1966-1967). *Cyanopica* 1: 95-132.

Guillemain, M., N. Sadoul & G. Simon 2005. European flyway permeability and abmigration in Teal *Anas crecca*, an analysis based on ringing recoveries. *Ibis* 147: 688-696.

Lebret, T. 1947. The migration of the Teal *Anas crecca crecca* L. in Western Europe. *Ardea* 35: 79-131.

OIE - World Organisation for Animal Health. 2006. Update on avian influenza in animals (type H5) - 01 June 2006. *http://www.oie.int/downld/AVIAN%20INFLUENZA/A_AI-Asia.htm*

Oliveira, N.G. 1974. Recapturas em Portugal de aves anilhadas no estrangeiro (1968-1971). *Cyanopica* 1: 51-73.

Olsen, B., V.J. Munster, A. Wallensten, J. Waldenström, A.D.M.E. Osterhaus & R.A.M. Fouchier 2006. Global Patterns of Influenza A Virus in Wild Birds. *Science* 312: 384 - 388.

Poysa, H. & P. Nummi 1992. Comparing two methods of data collection in waterfowl habitat use counts. *Bird Study* 39: 124-131.

Ridgill, S.C. & A.D. Fox 1990. *Cold Weather Movements of Waterfowl in Western Europe*. IWRB Special Publication 13. Slimbridge, UK.

Rodrigues, D.J.C. 2001. *Ecologia e Ordenamento de Populações de Pato-real (*Anas platyrhynchos *L.) em Zonas Húmidas Portuguesas*. PhD Thesis, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Portugal.

Rodrigues, D.J.C., A.M.D. Fabião, M.E.M.A. Figueiredo & P.J.Q. Tenreiro 2000. Migratory status and movements of the Portuguese Mallard (*Anas platyrhynchos*). *Vogelwarte* 40: 292-297.

Rodrigues, D.J.C., A.M.D. Fabião & M.E.M.A. Figueiredo 2001. The use of nasal markers for monitoring Mallard populations: pp. 316-318 in R. Field, R.J. Waren, H. Okarma, and P.R. Sievert (eds.). Wildlife, land, and people: priorities for the 21st century. *Proceedings of the Second International Wildlife Management Congress*. The Wildlife Society, Bethesda, Maryland, USA.

Saez-Royuela, R. & T.S. Martinez 1985. *Estudio sobre la Biologia Migratoria del Orden Anseriformes (Aves) en España*. Sociedad Española de Ornitologia, Madrid.

Scott, D.A. & P.M. Rose 1996. *Atlas of Anatidae Populations in Africa and Western Eurasia*. Wetlands International Publication Nº41. Wetlands International. Wageningen, The Netherlands.

Silva, M.A. & M.F.C. Castro 1991. *Recaptura de aves com anilha estrangeira em Portugal e com anilha CEMPA no estrangeiro (1977-1988)*. Serviço Nacional de Parques Reservas e Conservação da Natureza, Lisboa.

Silva, M.A. & M.F.C. Castro 1992. Recuperação de anilhas entre 1989 e 1991. *Airo* 3: 90-120.

Tait, G.M. 1955. Aves anilladas capturadas en Portugal. *Ardeola* 2: 79-86.

Tait, G.M. 1960. Aves anilladas recuperadas en Portugal (Abril 1957 - Diciembre 1958). *Ardeola* 6: 259-278.

Tait, G.M. 1961. Aves anilladas recuperadas en Portugal (Enero - Diciembre 1959). *Ardeola* 7: 175-195.

Tait, G.M. 1962. Aves anilladas recuperadas en Portugal (Años 1960 y 1961). *Ardeola* 8: 189-222

Tamisier, A. & O. Dehorter. 1999. *Camargue, Canards et Foulques. Fonctionnement et devenir d'un prestigieux quartier d'hiver*. Centre Ornithologique du Gard, Nimes.

Wolff, W.J. 1966. Migration of Teal ringed in Netherlands. *Ardea* 54: 230-270.