Mauro Delogu
Department of Public Veterinary Health and Animal Pathology
- Bologna University-Italy
mauro.delogu@unibo.it

Type A

(8 RNA segments)

9 Kb

(*polimerasis complex*)

(PB1, *PB2*, PA) (Efficient growth)

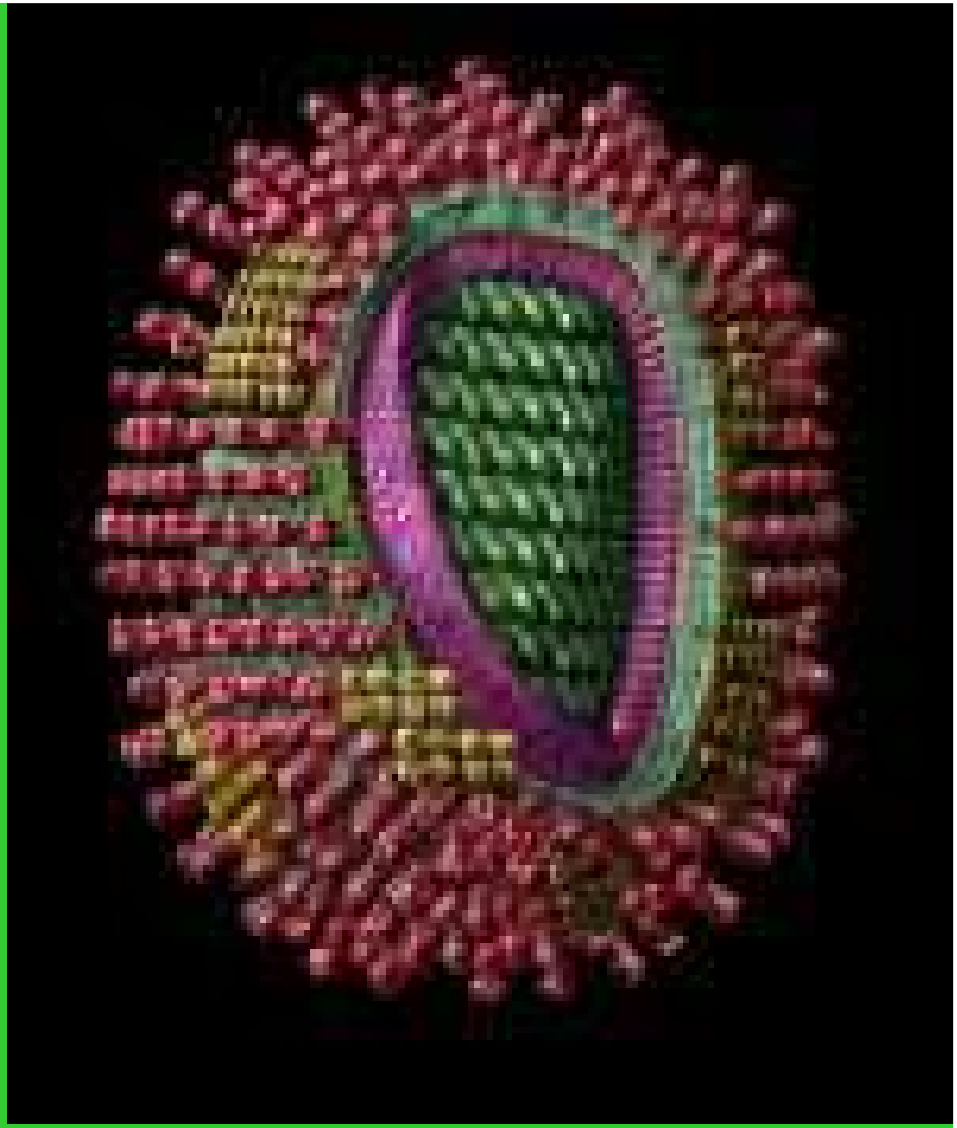
4° - HA (Haemoagglutinin) (Infectivity)

5° - NP(Nucleoprotein)

6° - NA (Neuroaminidase)

7° - M1 , M2 (MatrixProt.)

8° - NS .1, NS 2 (Pathogenicity)



Type A Mammals and Birds (At the time, 16 HA and 9 NA are known)

Type B Human

Type C Human

Dhori/Thogoto (Tick borne)

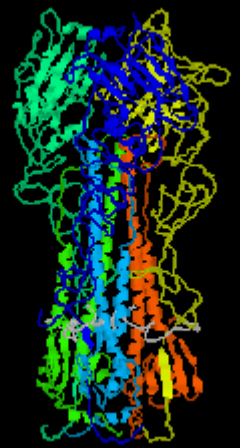
Mammals

Refresh genes Time = Reproductive cycle / Mutation rate
Human mutation
of single gene (1000 bases)
might take thousands of generations

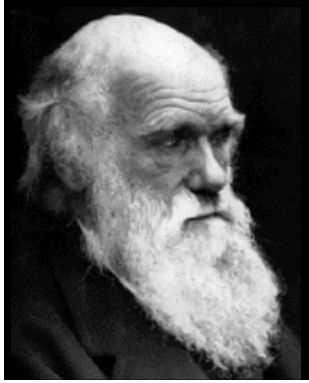
Antigenic drift / Shift
Recombination

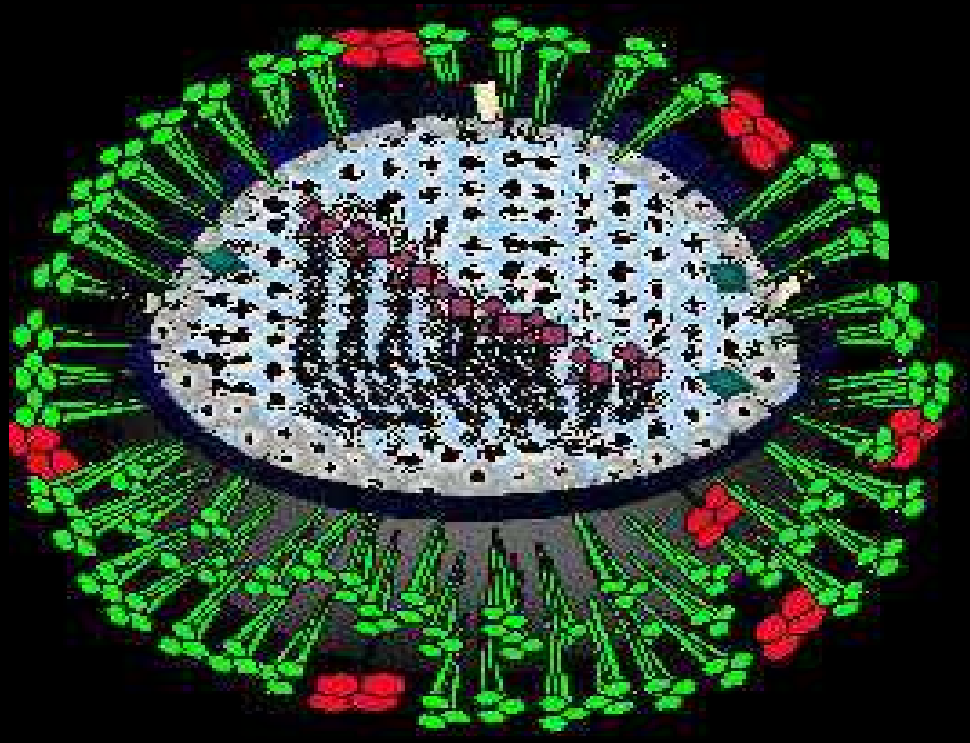
Macro Evolution

RNA virus exhibit the highest mutation rate of any group of organism
one per genome per replication
(around 10^{-3} / 10^{-5})



Micro Evolution



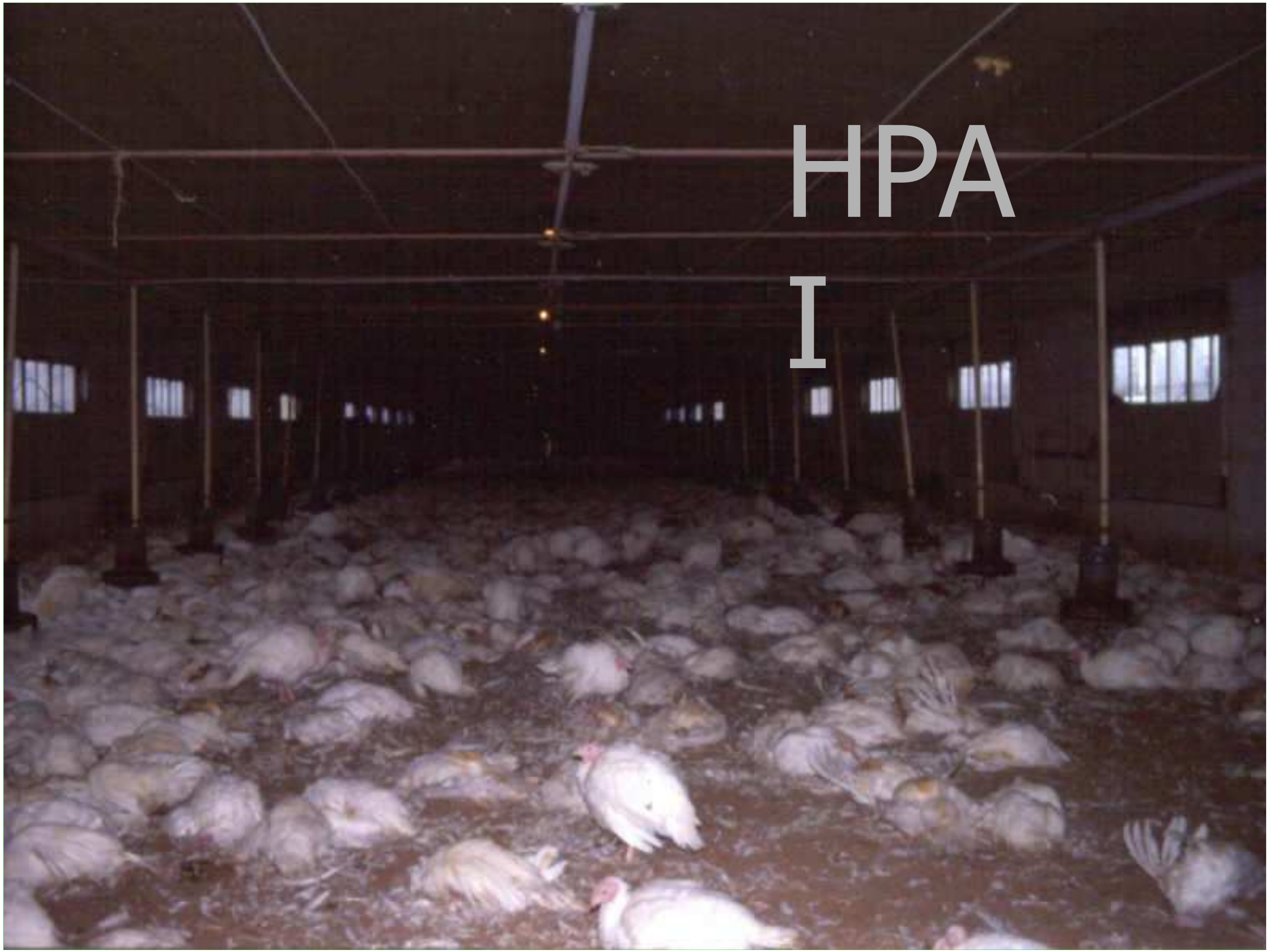


Population size

10^{12} viral particles in an organism

Population growt

one virus can produce 100.000 viral copies
in 10 hours


HPA
I

Avian viruses

H1 → H16, N1 → N9

H7 N7 U. K. Dutch

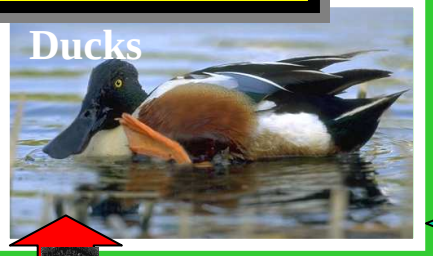
H5 N1 Hong-Kong 1997

H9 N2 "Chinese"

H5 N1 Hong-Kong 2003

H5 N1 Bruxel 2004

H5N3



H10 N4

Horse viruses

H3N8 / H7N7

H3N8
2004

mixing

H1N1
H2N2
H3N2

During flu A coinfection In swine, the genetic reassortement between birds and mammals viruses is possible.

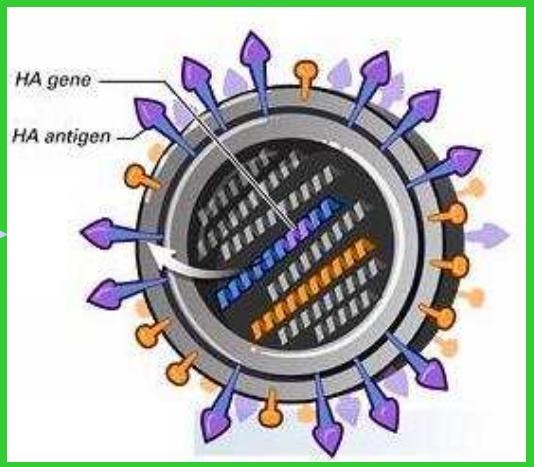
Marine mammal viruses

Un master di metamorfosi

Variabilità antigenica

Virus Influenzali

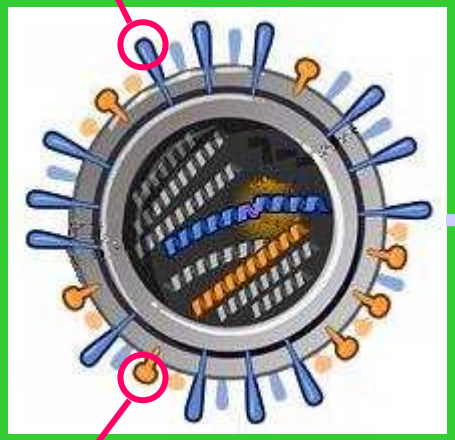
Antigenic Drift



Tipo A, B

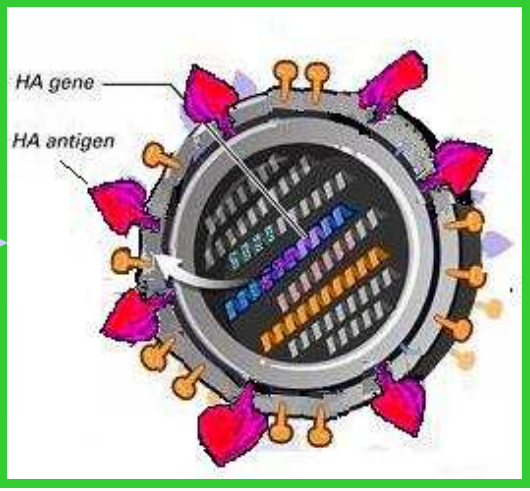
epidemico

(HA)



(NA)

Antigenic Shift

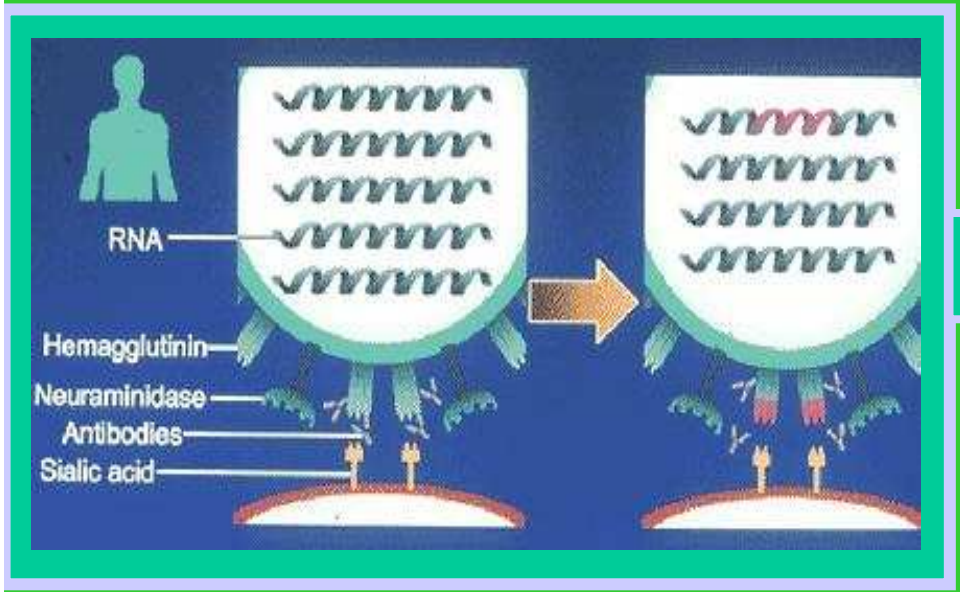


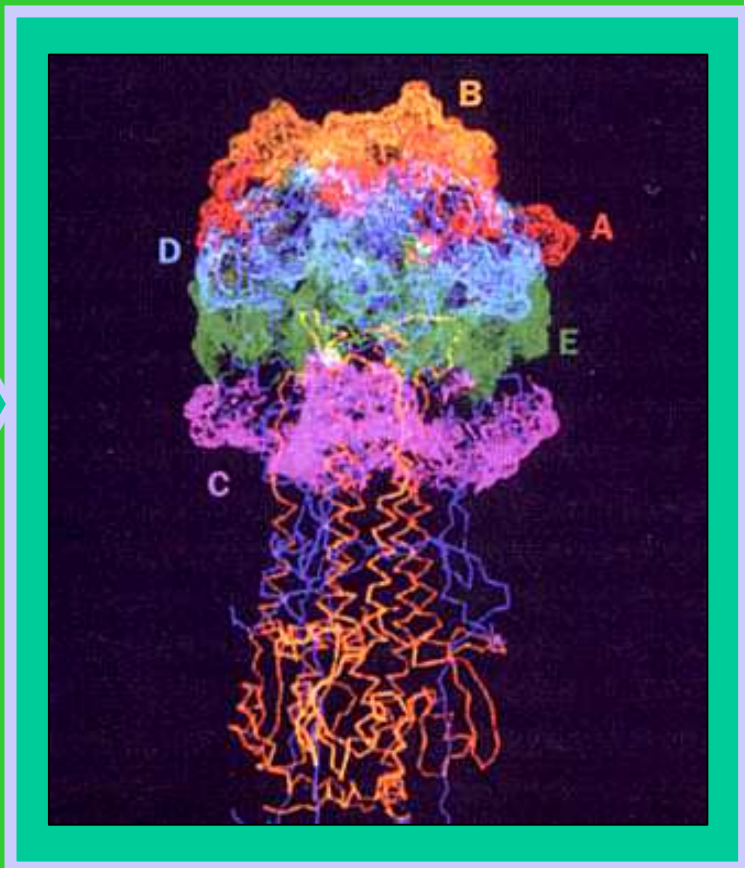
Tipo A

pandemico

Flu A & Flu B:
antigenic drift

Mutazioni casuali → **cambiano HA/NA**

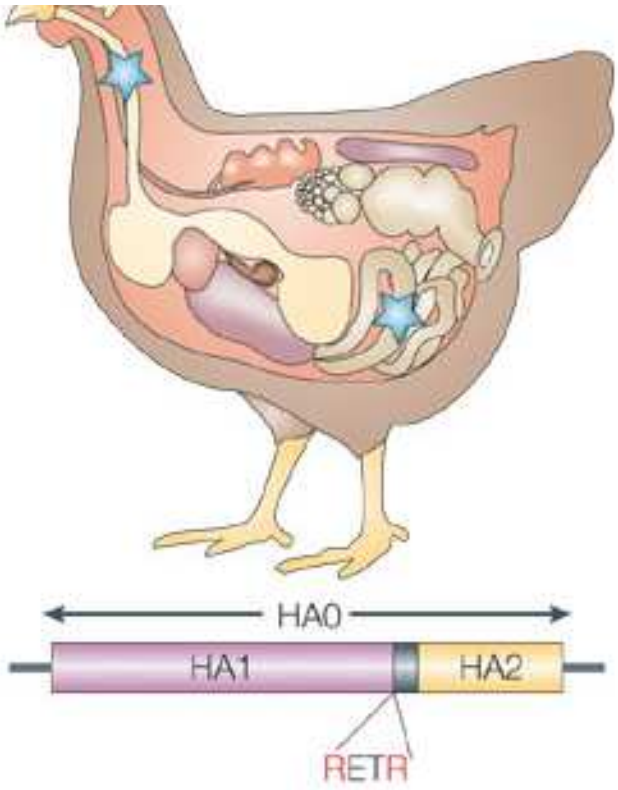




Sequenza di aminoacidi basici (R / K) nel sito di clivaggio dell'emoaglutinina (HA0 - HA1/HA2)

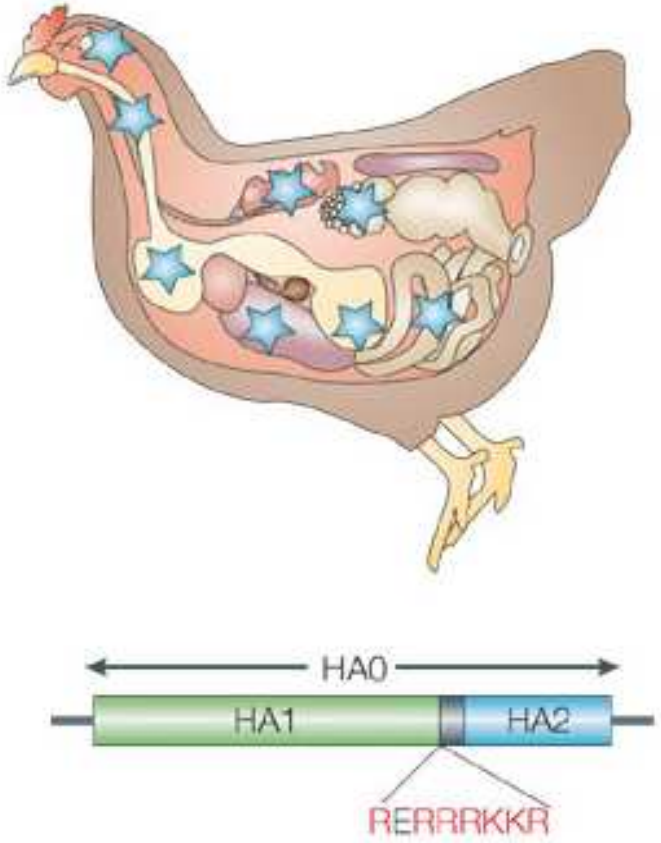
LPAI

Proteasi localizzate negli organi respiratori e nell'intestino



HPAI

Proteasi ubiquitarie **(Furina like)**

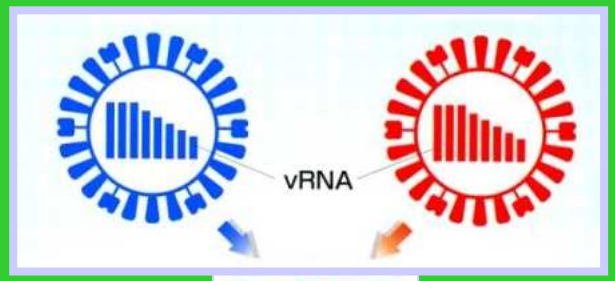


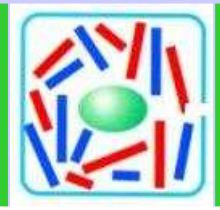
Influenza A: *antigenic shift*

Modello1

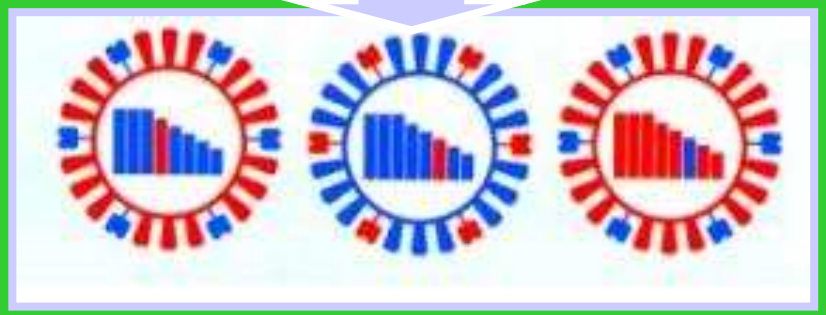
Flu A Aviaria

Flu A Umana





riassortimento



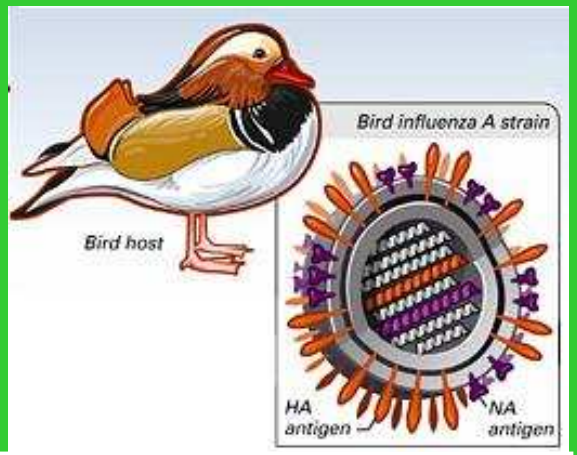
Modello2

Flu A Aviaria

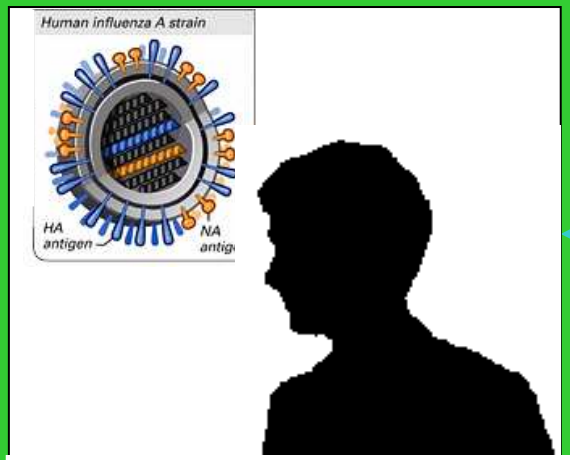
Salto di specie

UOMO

antigenic shift
MODELLO 1: riassortimento



Virus dell'influenza aviario



Virus dell'influenza umano

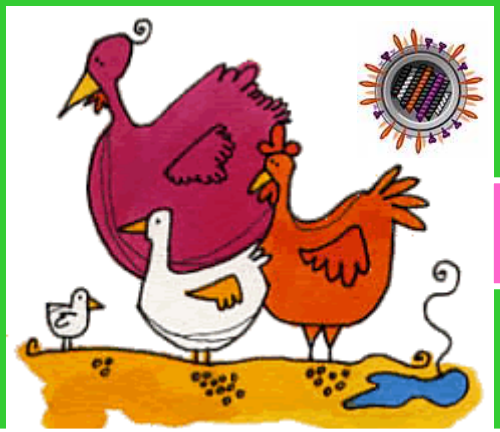
MIXING VESSEL

Recettori α2,3 α2,6

Virus riassortante

antigenic shift

MODELLO 2: salto di specie

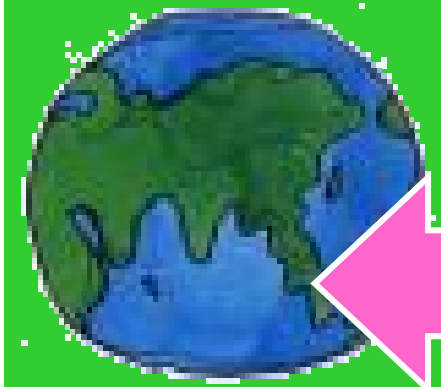


Virus dell'influenza aviario

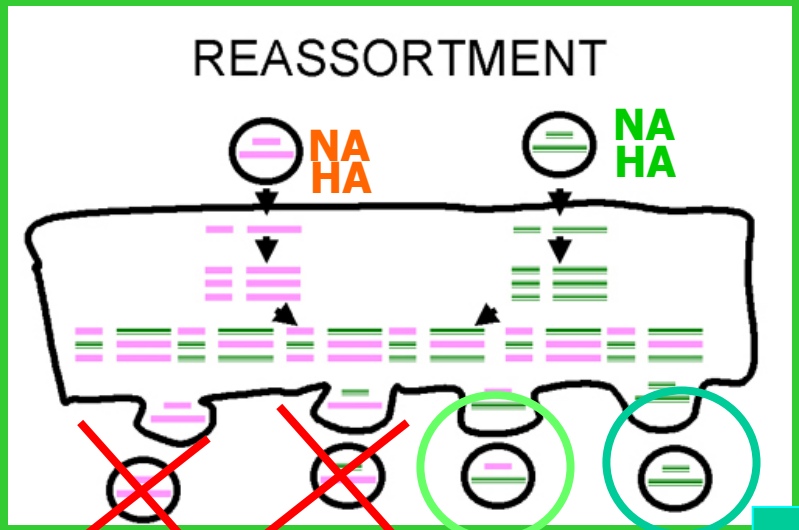
Salto di specie

UOMO

Virus dell'influenza umano



Biogenesi di ceppi pandemici *match* HA-NA



SET GENICI ISOLATI IN NATURA:

UOMO: H1H1,H2N2, H3N2,
SUINO: H3N2, H1H1

Match **HA/NA non funzionale**

Match **HA/NA funzionale**

Match **HA/NA poco funzionale**

Mutazioni post-riassortimento

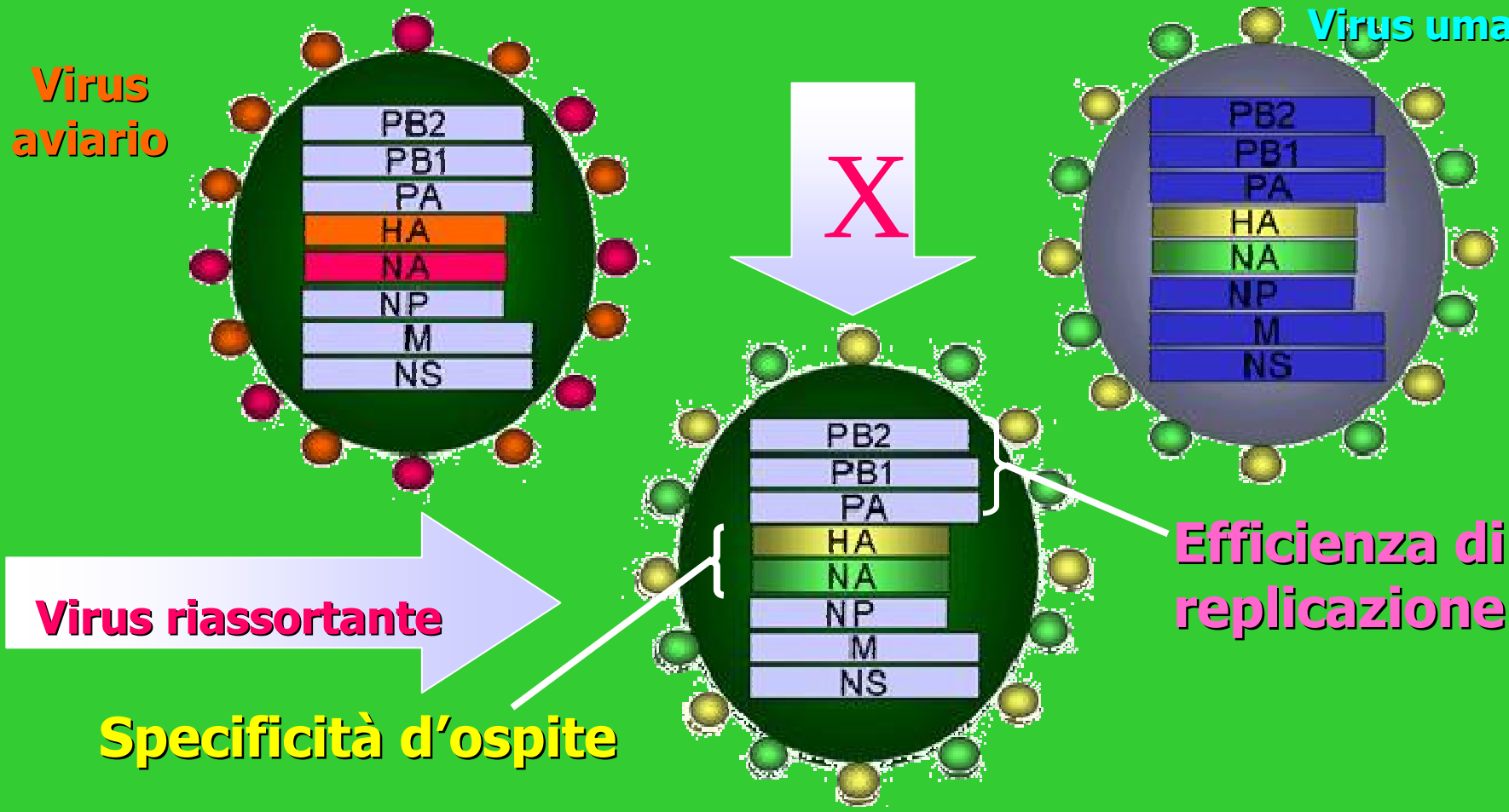
Biogenesi strand pandemici

Persistenza nella popolazione ospite

Biogenesi di ceppi pandemici

Capacità replicativa

Complesso polimerasico:
PB1, PB2, PA



Pandemie Influenzali

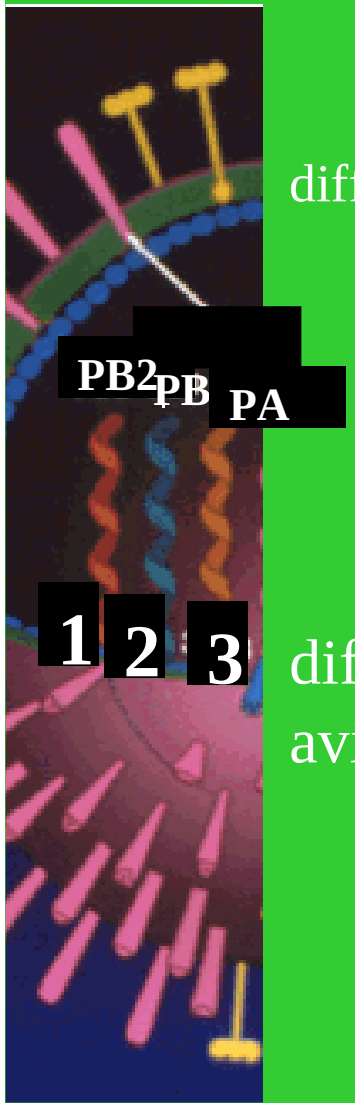
1918	(Spanish Flu)	H1N1
1957	(Asian Flu)	H2N2
1968	(Hong Kong Flu)	H3N2
1977	(The USA)	H1N1

Dal 1977 H3N2 e H1N1 co-circolano

The 1918 flu virus is resurrected

JK Taubenberger
Nature 6 ottobre 2005

Caratterizzazione molecolare dei geni di PA-PB1-PB2



È un virus *"avian-like"*

differiscono solo di pochi aminoacidi dalle sequenze *consensus* aviarie:

7 PB1
7 PA
5 PB2

→ **aa 627** → Importante per l'adattamento alle cellule di mammifero

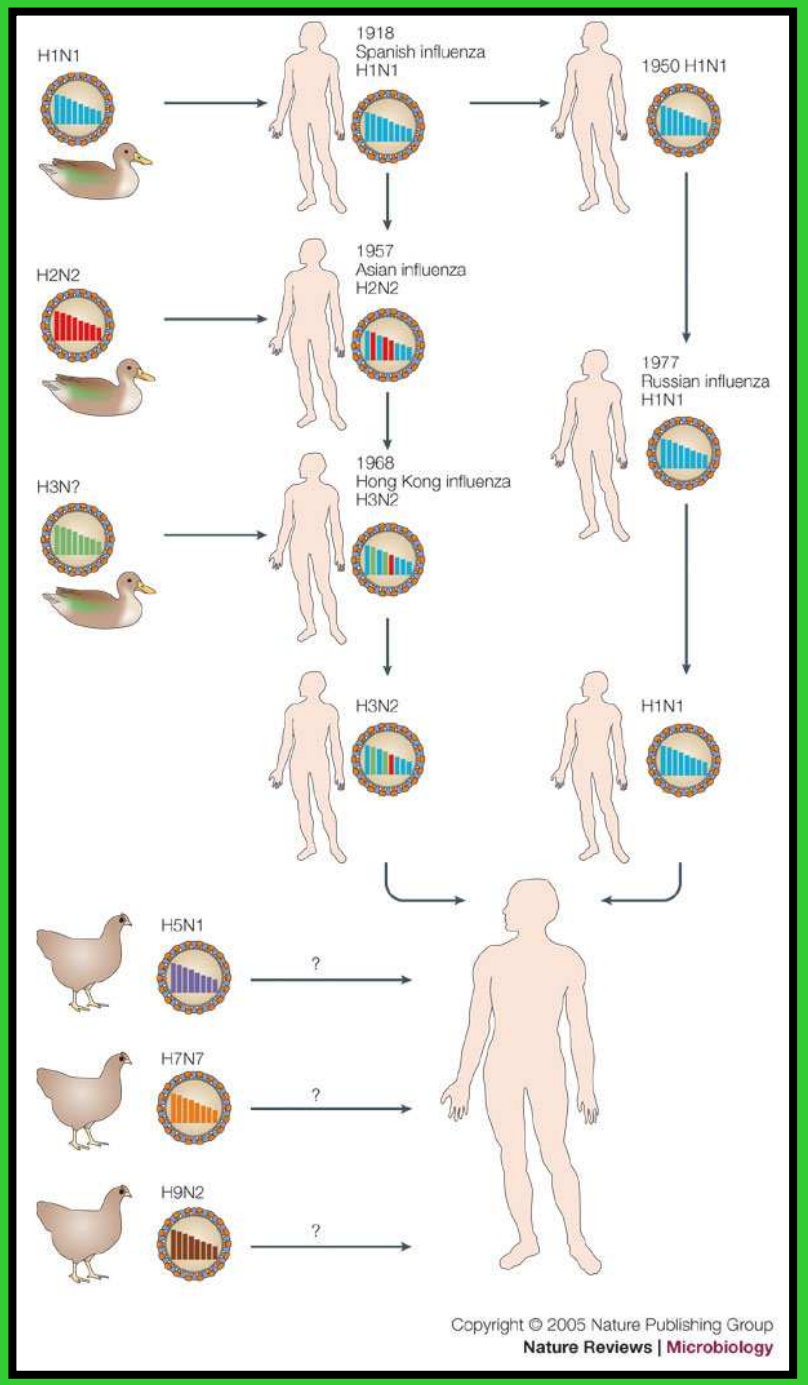
Alta virulenza:

differenza di **10 aa** per il complesso polimerasico tra virus aviari e umani

H1N1
H5N1
H7N7

→ Codoni codificanti il peptide F2 di PB1 (induzione della morte cellulare)

Pandemie Influenzali: Passate e Future?




The New York Times
L'influenza mette le ali

Infezioni umane da virus aviari

1997	H5N1	HK: 18 casi, 6 morti
1999	H9N2	HK, Cina: 7 casi
Feb 2003	H5N1	HK: 2 casi, 1 morto
Feb 2003	H7N7	NDL: 83 congiuntiviti, 1 morto
Dec 2003	H9N2	HK: 1 caso
Mar 2004	H7N3	Canada: 2 casi
Jan 2004-Oct 2005	H5N1	(118 casi, 61 morti)

Reservoir : Why Ducks?

Species where the virus can replicate and maintain itself indefinitely in the time

Water related species

Migratory behaviour

Cyclic Interaction between populations coming from different areas

Intestinal virus replication

Virus shedding by means of faeces (from 2 to 4 weeks)

The Duck populations wintering in Western Palearctic ranges between 13 and 15 million of birds

The Mallard duck has an European population near 5 million of birds, 75000/100.000 of these are wintering in Italy

The Teal winters in Mediterranean areas with 2,5 million of birds (51.000 in Italy)

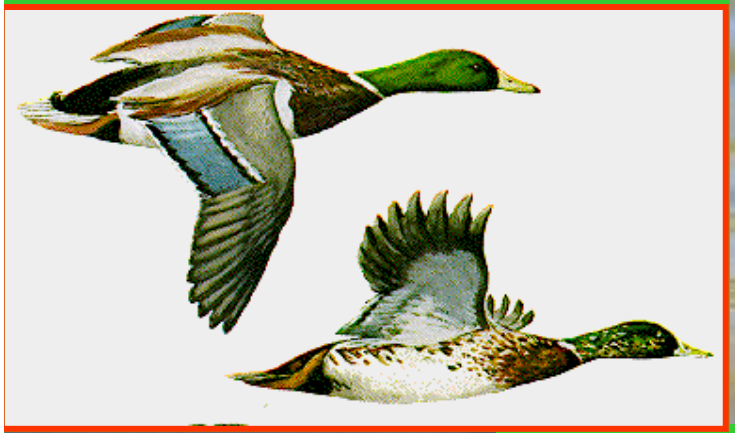
The Wigeon winters in the same region with 1,5 million (71.000 in Italy)

The Pintail has 1,3 million of birds (200.000 winter in the Mediterranean areas)

The Shoveler European population consists of 1 million of birds, 100.000 of these winter in Mediterranean areas and 20.000 in Italy

The Pochard winters in the Mediterranean areas with 750.000 birds (43.000 in Italy)

The Tufted duck winters in Italy with 8.500 birds



Duck migrations in Europe from N/E to S/W

Moulting areas : Aggregation of many different ducks and viruses populations (during - June, Jul y)

REPRODUCTIVE AREAS

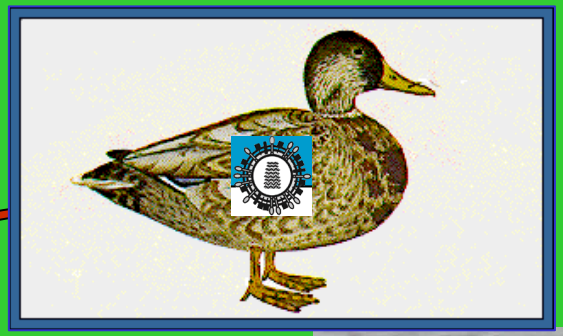
Post-reproductive- first step- May, June Moult migration

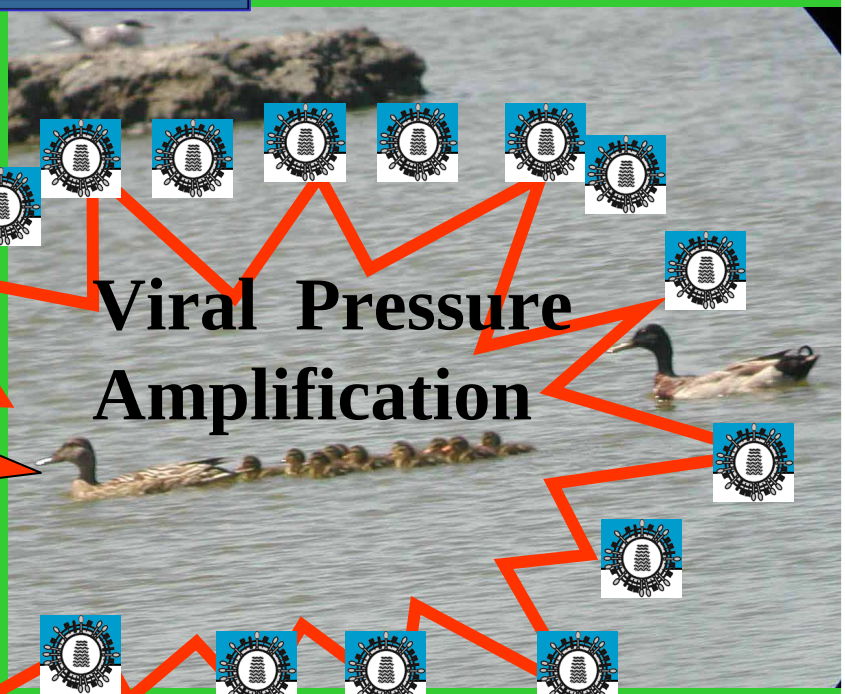
REPRODUCTIVE AREAS

Wintering migrations - second step- from August to October

Wintering areas

Endemic Subtypes *e.g.* HA1
Summer /Autumn Period
(Population with immunity)





Adults 50%

Young Ducks 50%

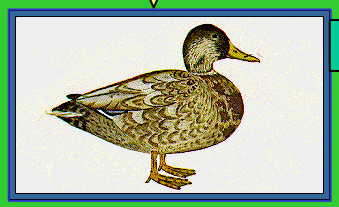
Ducks population Structure

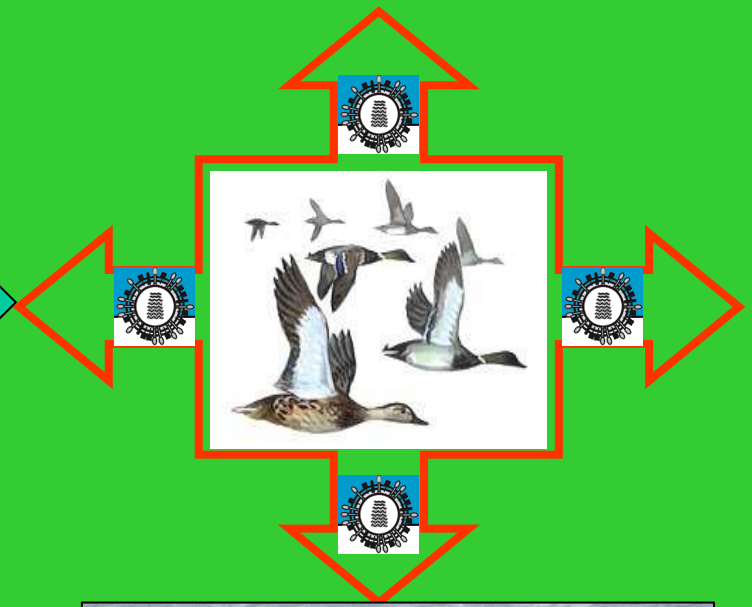
“ *New* Subtypes”

Population without immunity

e.g **H7**

(Italy, 2001)



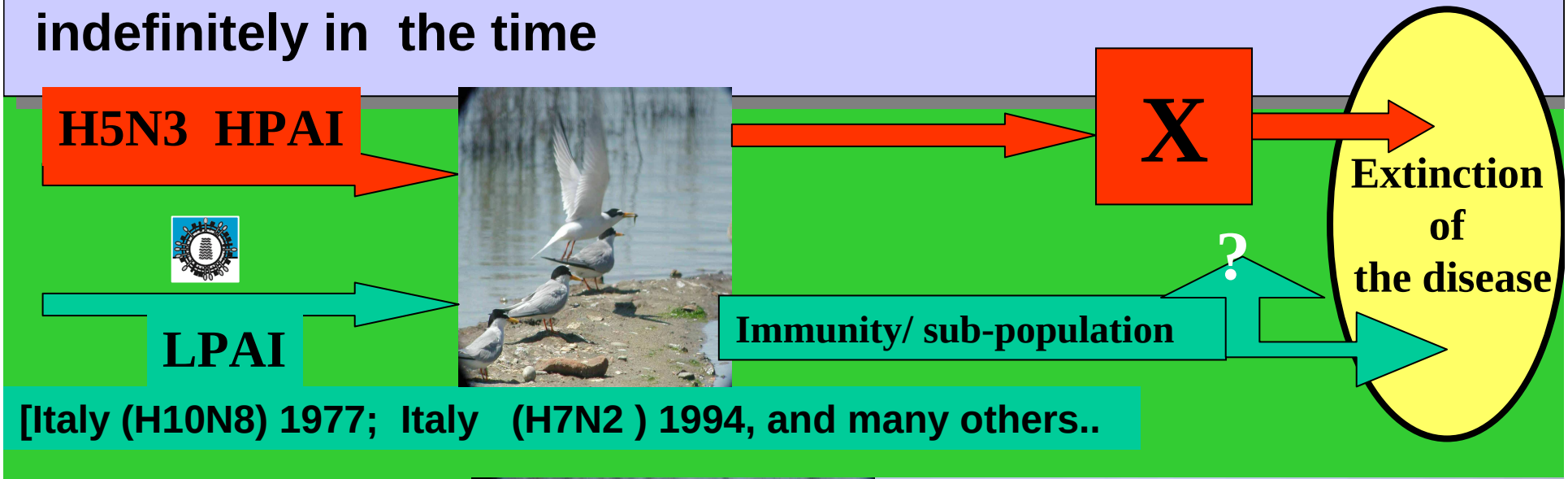


Epiphenomenon species:

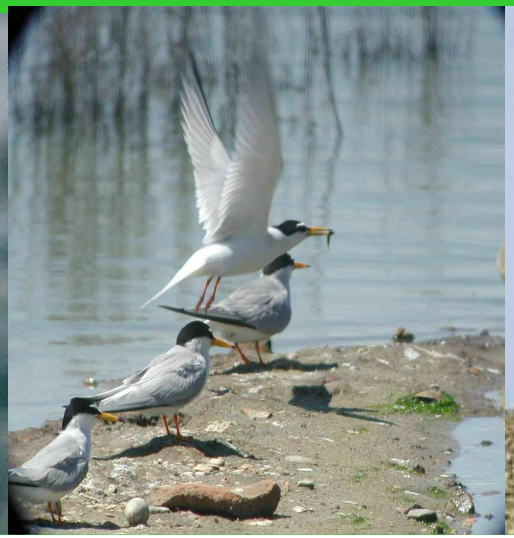
Host species where the virus can spread and replicate

but in this species the virus is not be able to maintain itself

indefinitely in the time

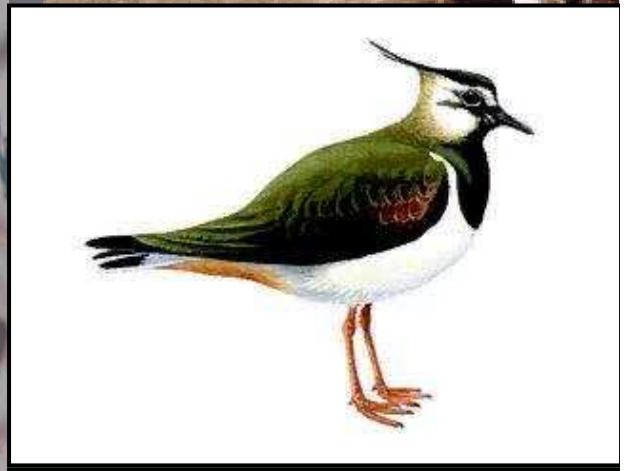


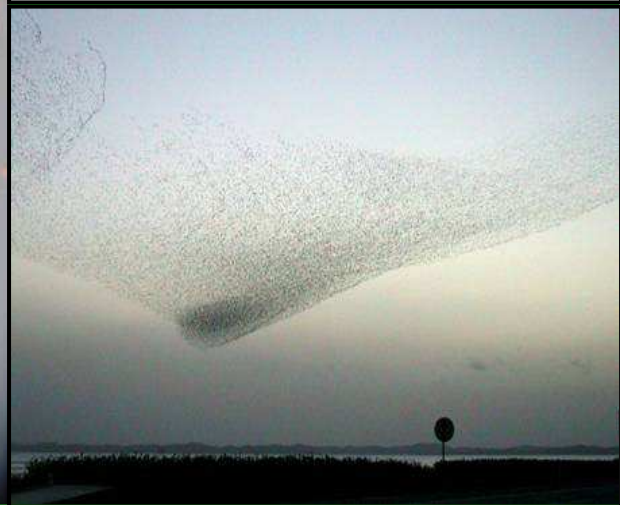
[Italy (H10N8) 1977; Italy (H7N2) 1994, and many others..

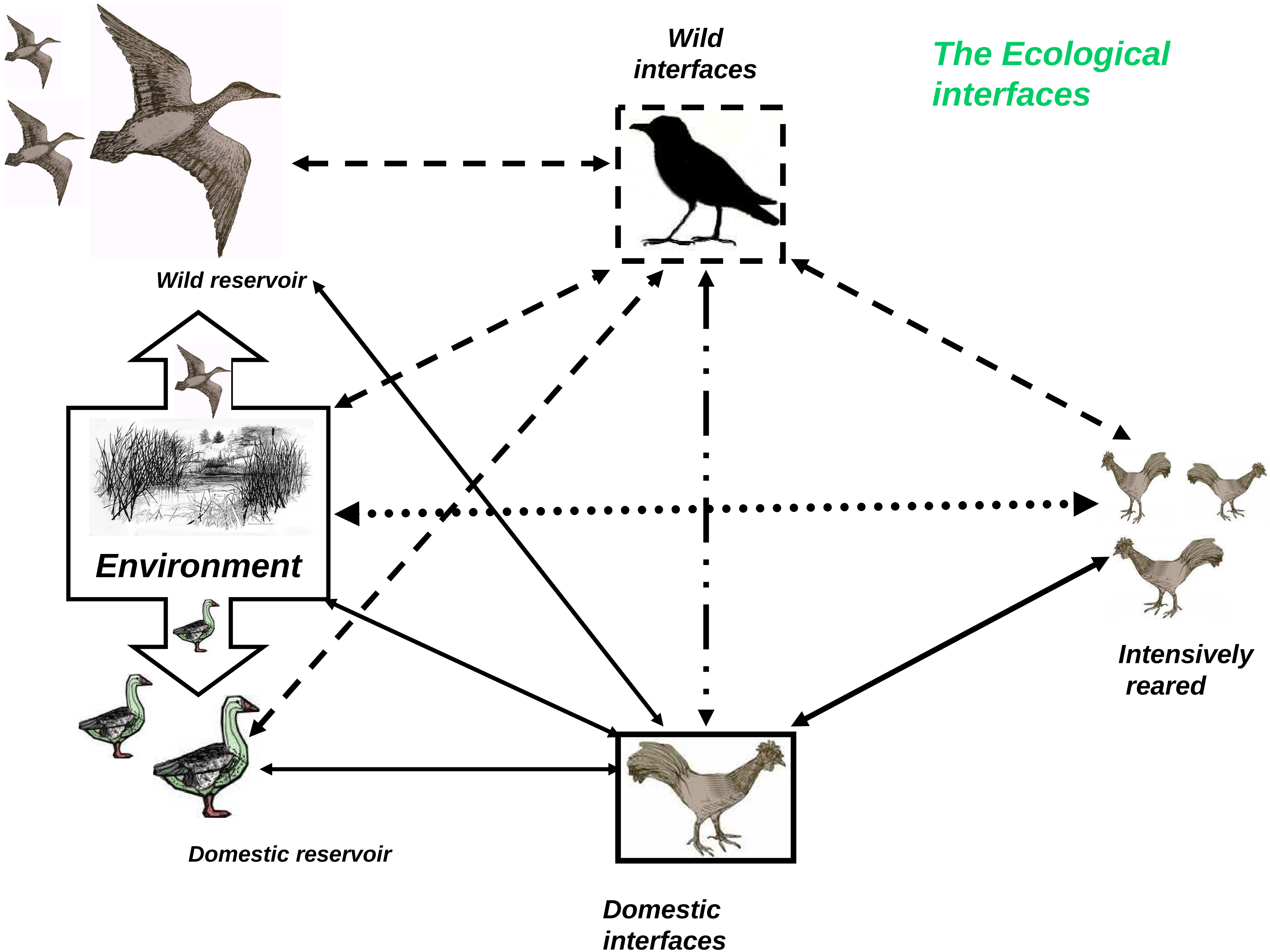


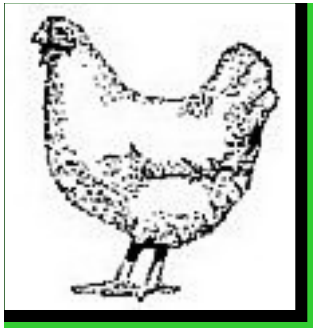
Epiphenomenon role during migration

-flock size
-migratory in long/ short distance
-time necessary to migrate
-migration routes and stages






The Ecological interfaces
Wild interfaces
Wild reservoir
Environment
Intensively reared
Domestic reservoir
Domestic interfaces

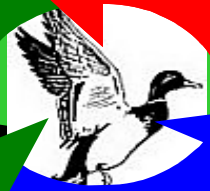


The chicken's role *(strains LPAI/HPAI)*

HPAI **H5/H7**

threshold

Epifenomena



Reservoir

Environmental factors and immunity

The host (duck) and the virus have developed a coevolution, in this condition the virus live an evolutionary freezing

With low frequency of viral changes

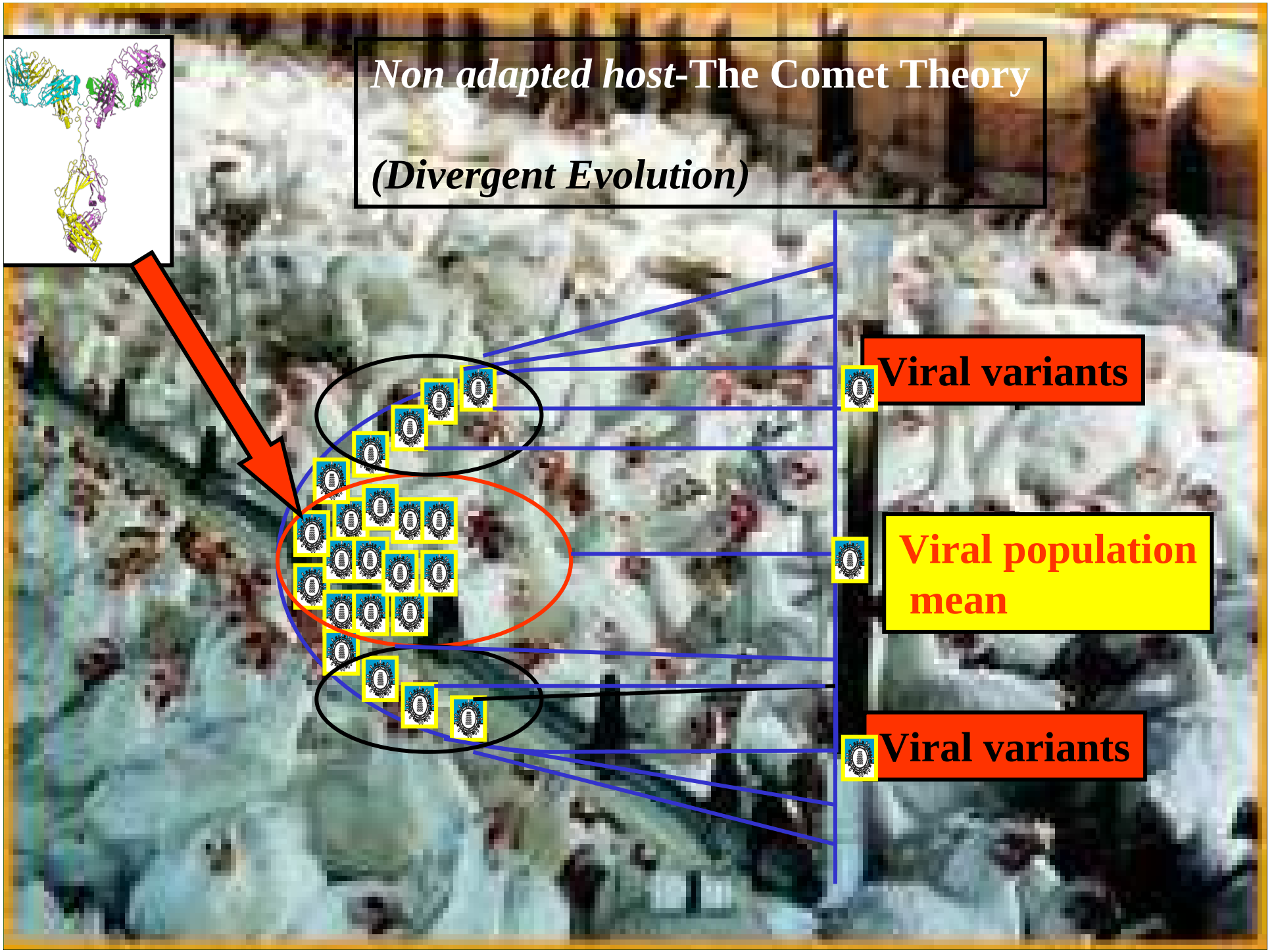
(Convergent evolution)

Few viral variants

mean

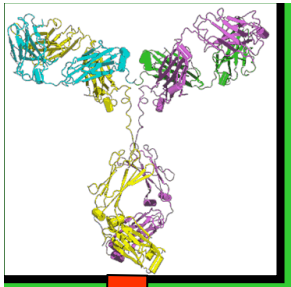
Few viral variants

Viral population

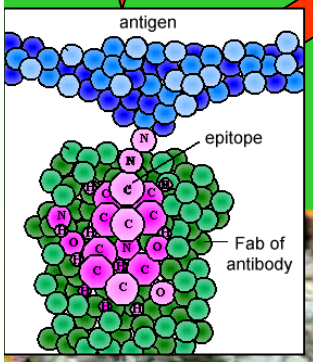

Non adapted host-The Comet Theory
(Divergent Evolution)
Viral variants
Viral population mean
Viral variants

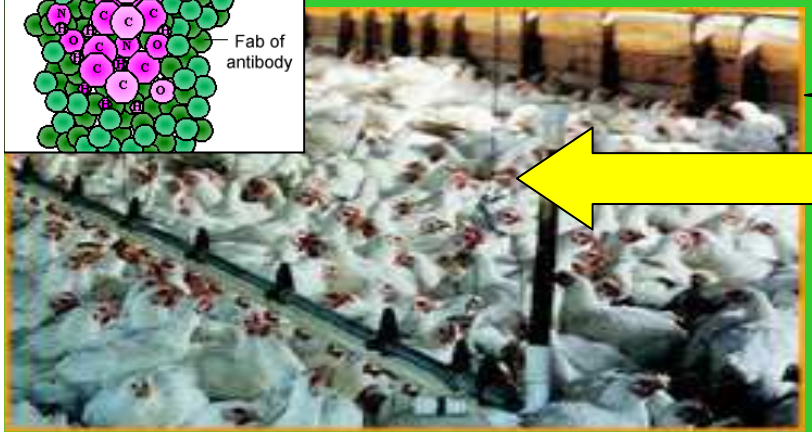
The Comet Theory

Divergent Evolution



Molecular mimicry





why ?

Bottleneck

Many viral variants

+

X

Viral population mean

+

-

Many viral variants

High frequency of viral changes

host and virus without coevolution

host with high population turn over

During Poultry infection,
the possible evolution from LPAI to HPAI may occur

HPAI

HPAI usually kill the domestic and wild reservoirs only in the first outbreak period;

HPAI kills domestic non reservoir birds (i.e. chickens, Turkeys). and some wild epiphenomenon species.

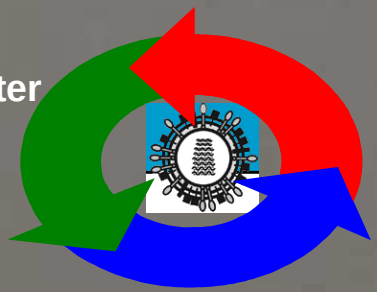
subsequently the virus could reduce its patogenicity for the reservoir and the spread of the infection by migrations might be possible.

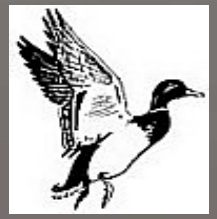
LPAI

Ecological interfacies

Domestic reservoir LPAI

Contaminated water

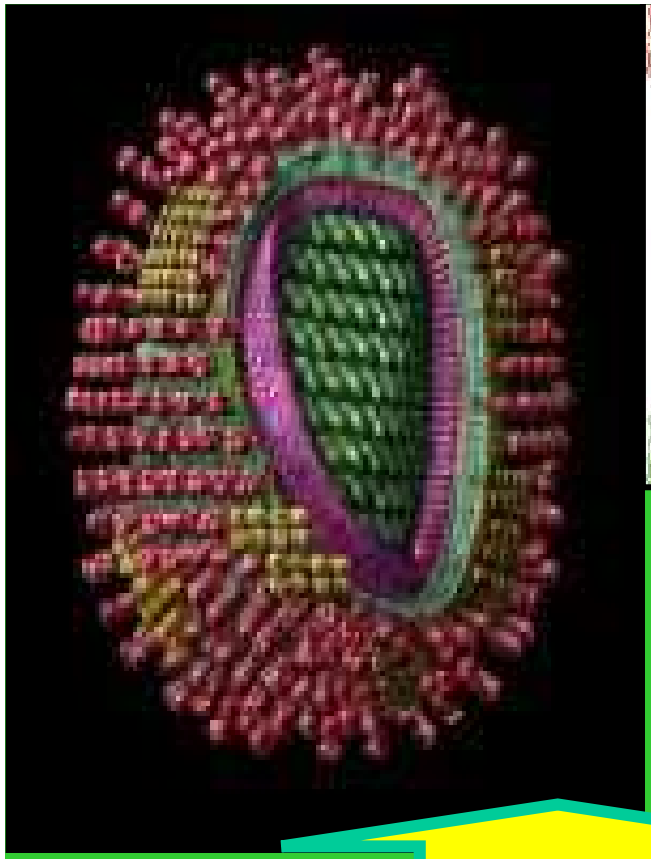


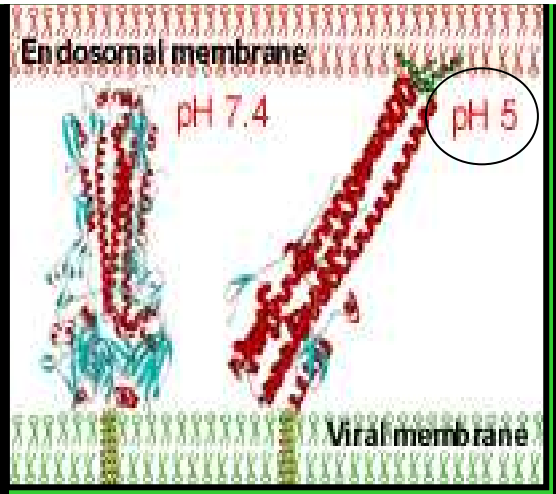


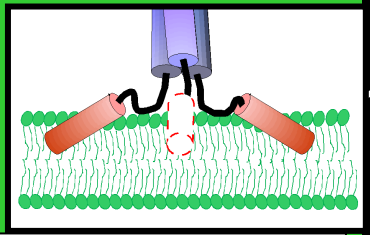
Wild reservoir LPAI

LPAI

Epiphenomenon species





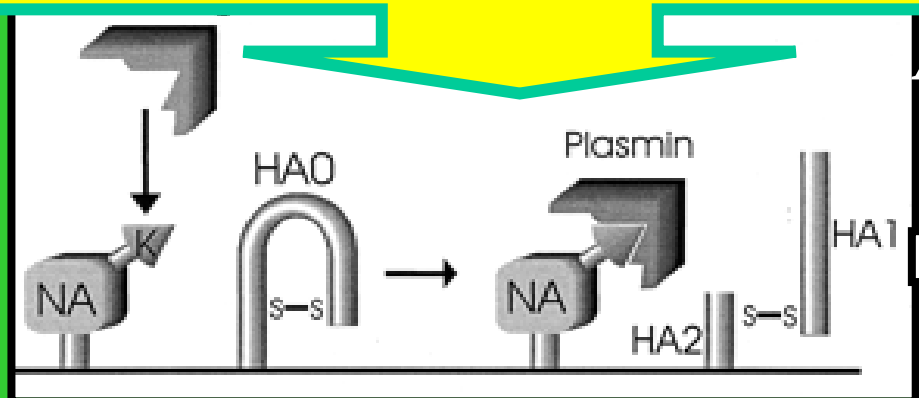


Infectivity

Amino acid 627 in PB2 and Efficient growth

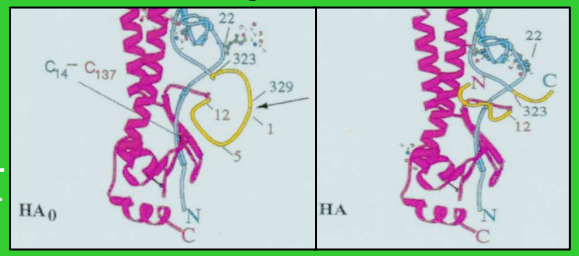
Uncoating

The host spectrum



Attachment

Proteolytic activation



Structure of the cleavage site and pathogenicity

Tabelle di sensibilità e specie colpite: interpretazione del ruolo

-spill over

- fattori di presenza : presenza incostante o meno sul territorio

- momento biologico delle specie (- + giovani sensibili)

- assenza di informazioni sullo stato immunitario della popolazione

Order: Anseriformes							
Cygnus atratus	Black swan		+			+	Ellis et.al. 2004
Cygnus cygnus	Whooper Swan	+				+	20050826.2527
C.melanocoryphus	Black-necked swan		+			+	Ellis et al. 2004
Cygnus olor	Mute swan	+				+	Update on Avian Influenza #35
Dendrocygna viduata	White-faced whistling-duck		+			+	Ellis et.al. 2004
Branta sandvicensis	Hawaiian goose		+			+	Ellis et.al. 2004
Netta peposaca	duck		+			+	Ellis et.al. 2004
Netta rufina	pochard		+			+	Ellis et.al. 2004
Tadorna ferruginea	Ruddy shelduck	+				+	Information Vol.18-no.21

Order: Charadriformes							
Larus atricilla	Laughing gull					+	-	Perkins and Swayne, 2003
Larus brunnicephalus	Brown-headed gull	+	+			+	Chen et.al. 2005;and Liu et.al. 2005
Larus ichthyaetus	Great black-headed gull	+	+			+	Chen et.al. 2005;and Liu et.al. 2005
Larus ridibundus	Black-headed gull	+				+	Ellis et.al. 2004
Tringa ochropus	Green sandpiper	+				-	OIE Mission to Russia 2005
Order: Ciconiiformes							
Anastomus oscitans	Asian open-billed stork	+				+	ProMED 20041214.3303
Ardea cinerea	Grey heron	+				+	Ellis et.al. 2004
Ardea herodias (?)	Great blue heron	+				+	ProMED 20051130.3460, 20051201.3463 (HPAI H5)
Ardeola bacchus	Chinese pond heron	+				+	OIE 2005 Disease Information Vol. 18-no2
Egretta garzetta	Little egret	+				+	Ellis et.al. 2004

Order: Columbiformes							
Columba livia	Feral pigeon	+			+	+	Ellis et.al. 2004
Streptopelia tranquebarica	Red-collared dove	+				?	ProMED 20041214.3303
Order: Falconiformes							
Falco peregrinus	Peregrine falcon	+				+	OIE 2004 Disease Infromation Vol.17-no.5; Hong Kong Final Report 7/30/03
Ichthyophaga ichthyaetus	Grey-headed fish-eagle		+			+	FAO AIDE report #16
Spilornis cheela?	Serpent eagle		+			+	FAO AIDE report #16
Spizaetus nipalensis	Crested hawk-eagle	+				-	van Borm et.al., 2005

Order: Galliformes							
Alectoris chukar	Chukar partridge				+	+	Perkins and Swayne, 2003
Colinus virginianus	Bobwhite quail				+	+	Perkins and Swayne, 2003
Corurnix coturnix japonicus	Japanese quail				+	+	Perkins and Swayne, 2003
Gallus domesticus	Domestic chicken		+			+	Subbarao et.al. 1998
Meleagris gallopavo	Turkey				+	+	Perkins and Swayne, 2003
Numida meleagris	Pearl guineafowl				+	+	Perkins and Swayne, 2003
colchicus	pheasant				+	+	Perkins and Swayne, 2004

Order: Gruiformes							
chloropus	Common moorhen	+				+	(HPAI H5)
Fulica atra	Coot	+				-	OIE Mission to Russia 2005
Rallina fasciata?	Brown (red-legged) crake	+				+	Xinhua News 1/11/06

Order: Struthioniformes							
novaehollandiae	Emu				+	-	2003

Order: Passeriformes							
Carpodacus mexicanus	House finch		+			+	Perkins and Swayne, 2003
Copsychus saularis?	Oriental magpie robin	+				+	Oriental Magpie Robin tests H5N1 positive
Corvus macrorhynchos	Jungle crow	+				+	Mase et.al., 2005, Report of the Highly Pathogenic Avian Influenza Infection Route Elucidation Team, June 30, 2004.
Dicrurus macrocercus	Black drongo	+				?	ProMED 20041214.3303
Gracula religiosa	Hill mynah		+			+	ProMED 20051021.3075; 20051022.3085.
Leiothrix lutea	Red-billed leiothrix		+			+	ProMED 20051021.3075; 20051022.3085.
Lonchura punctulata	Scaly-breasted munia	+				?	ProMED 20041213.3303
Oriolus chinensis chinensis	Black-naped oriole		+			+	ProMED 20051021.3075; 20051022.3085.
Passer domesticus	House sparrow		+			-	Perkins and Swayne, 2003
Passer montanus	Eurasian tree-sparrow	+				+	Ellis et.al. 2004
Pica pica sericea	Korean magpie	+				+	Kwon et al. 2005
Sturnus vulgaris	European starling				+	-	Perkins and Swayne, 2003
Taeniopygia guttata	Zebra finch				+	+	Perkins and Swayne, 2003

Order: Pelecaniformes							
Phalacrocorax carbo	Great cormorant	+				+	OIE 2005, Disease Information Vol.18-no.21
Phalacrocorax niger	Little cormorant	+				?	ProMED 20041214.3303
Order: Phoenicopteriformes							
Phoenicopterus ruber	Greater flamingo		+			+	Ellis et.al. 2004
Order: Psittaciformes							
Melopsittacus undulatus	Budgerigar				+	+	Perkins and Swayne, 2003
Order: Strigiformes							
Bubo nipalensis	Spot-bellied eagle-owl		+			+	FAO AIDE report #16
Ketupa ketupu	Buffy fish-owl		+			+	FAO AIDE report #16
Ketupa zeylonensis	Brown fish-owl		+			+	FAO AIDE report #16
Strix uralensis	Spotted wood-owl		+			+	FAO AIDE report #16

PROBLEMI NEL TROVARE GLIANIMALI MALATI

Gli animali malati e morti sono rapidamente
rimossi dai **predatori** e dagli **scavenger**, e perciò non disponibili per le indagini

Come quantificare i casi?

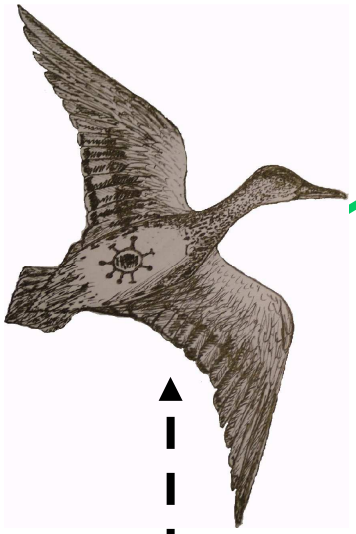
Soggetti ammalati: entità dei sintomi "collaborazione" della specie mezzi diagnostici "abilità" del veterinario nel **Trovare gli animali**

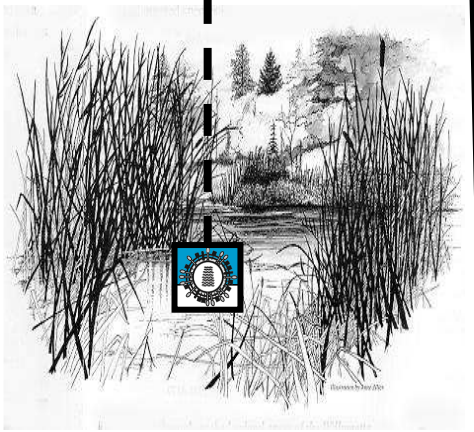
Ricerche di carcasse:
marcatura delle carcasse

Anatidi 0% (0/50)
12% (6/50)

Taglia Anatidi
Passeriformi

Eccezioni
costituite da alcune epidemie





LPAI

?

HPAI

HPAI

LPAI

WITH PROTECTIVE POPULATION IMMUNITY :

- Low virus replication in adults
- High virus replication in youngs

WITHOUT PROTECTIVE POPULATION IMMUNITY :

- High virus replication in all age classes of birds

WITH PARTIAL OR CROSS PROTECTIVE POPULATION IMMUNITY :

- Birds may became sick, do not die and may spread the infection

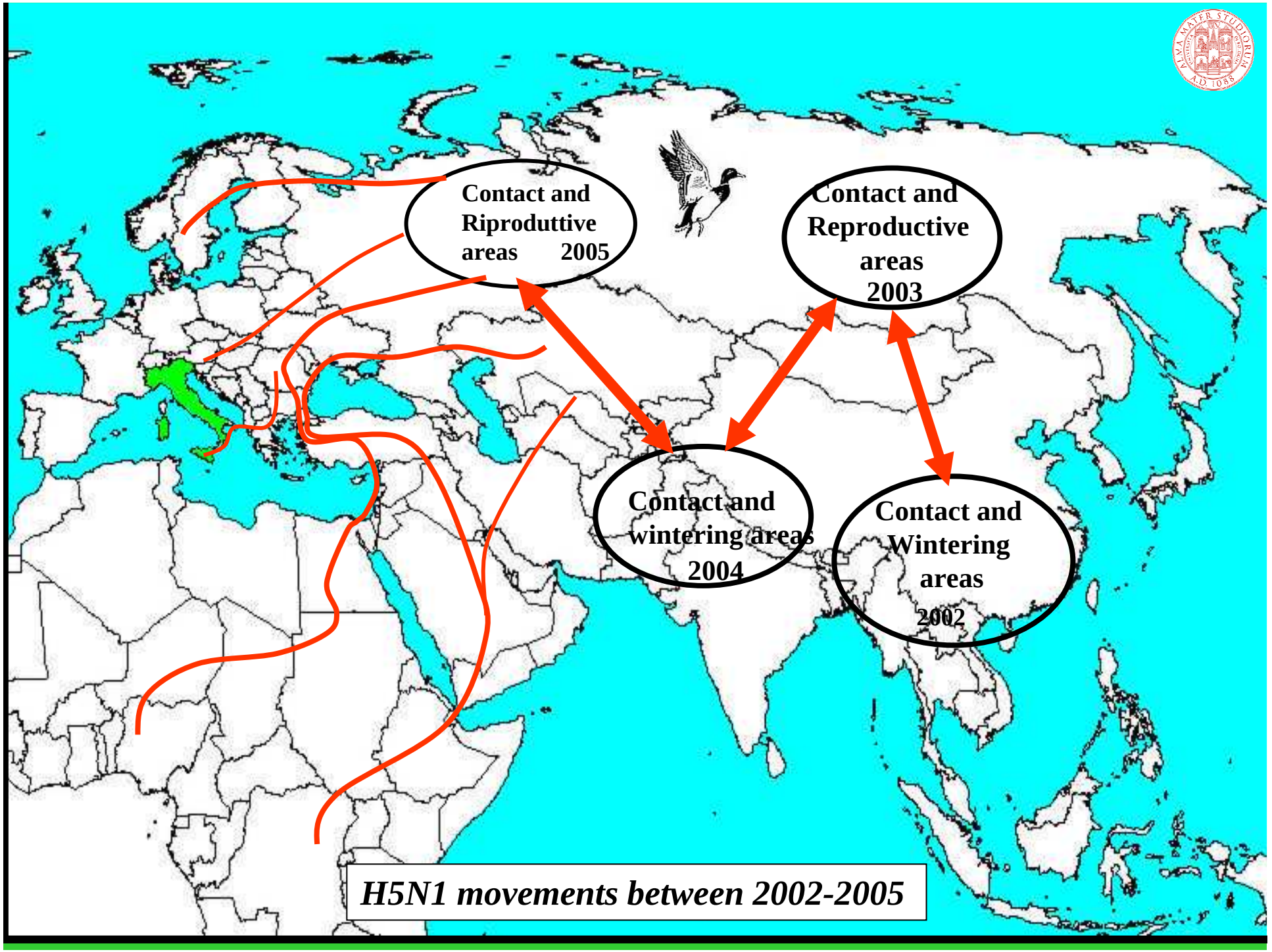
WITHOUT PROTECTIVE POPULATION IMMUNITY :

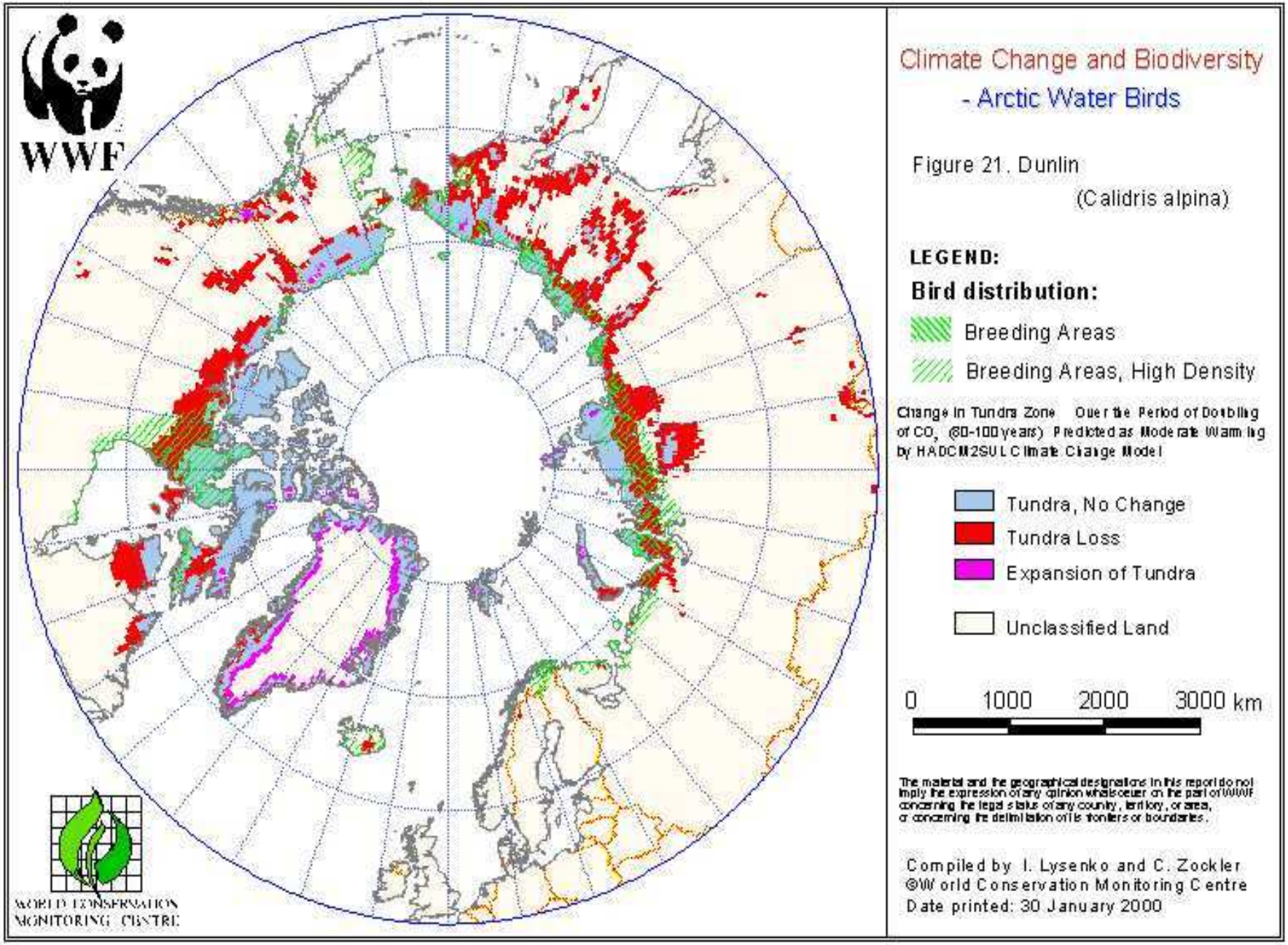
- Birds became infected and can die Quickly (LPAI H5N1)
- Birds became infected do not die and may spread the infection

FACTORS CODITIONING THE VIRAL SPREAD

- Incubation period
- Virus shedding
- Age of the bird
- Persistence of the virus in the environment
- Dimension of the flock
- Migration activities
- Congregation factors
- Season
- Others

In Late 2002 an outbreak of HPAI H5N1 cause dead among resident waterfowl and wild migratory birds in two Hong Kong nature parks. (Sturm, Ramirez *et al*. 2003)


Contact and Riproduttive areas 2005
Contact and Reproductive areas 2003
Contact and wintering areas 2004
Contact and Wintering areas 2002
H5N1 movements between 2002-2005


WWF
Climate Change and Biodiversity
- Arctic Water Birds
Figure 21. Dunlin
(Calidris alpina)
LEGEND:
Bird distribution:
Breeding Areas
Breeding Areas, High Density
Change in Tundra Zone Over the Period of Doubling of CO2 (80-100 years) Predicted as Moderate Warming by HADCM2SUL Climate Change Model
Tundra, No Change
Tundra Loss
Expansion of Tundra
Unclassified Land
0 1000 2000 3000 km
The material and the geographical designations in this report do not imply the expression of any opinion whatsoever on the part of WWF concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries.
Compiled by I. Lysenko and C. Zockler
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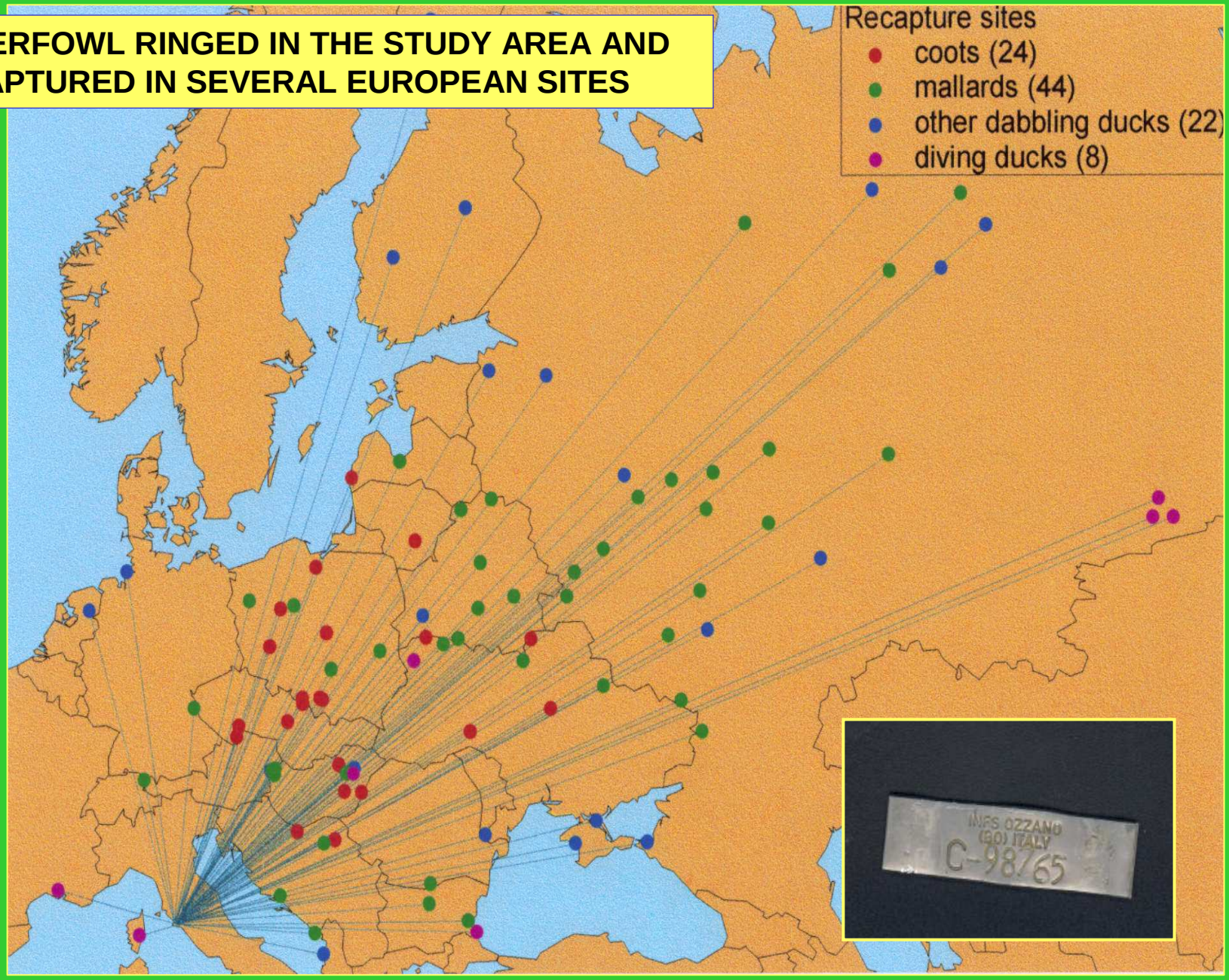
Date printed: 30 January 2000
WORLD CONSERVATION MONITORING CENTRE


WWF
STUDY AREA
ORBETELLO LAGOON
TUSCANY - ITALY
VIROLOGICAL AND SEROLOGICAL
INFLUENZA SURVEILLANCE SYSTEM
(ISS - OMS National Influenza Center)
AMONG WILD WATERFOWL, SINCE 1992
Image © 2006 DigitalGlobe
Pointer 42°26'04.56" N 11°12'11.16" E
Streaming 100%
Eye alt 11.58 mi

Monitoring the lagoon with sentinel ducks

Research in the reservoir species:

WATERFOWL RINGED IN THE STUDY AREA AND RECAPTURED IN SEVERAL EUROPEAN SITES



Flyways and movements

Black sea Mediterranean Flyway

Central Asia Flyway

East Asia Australian Flyway

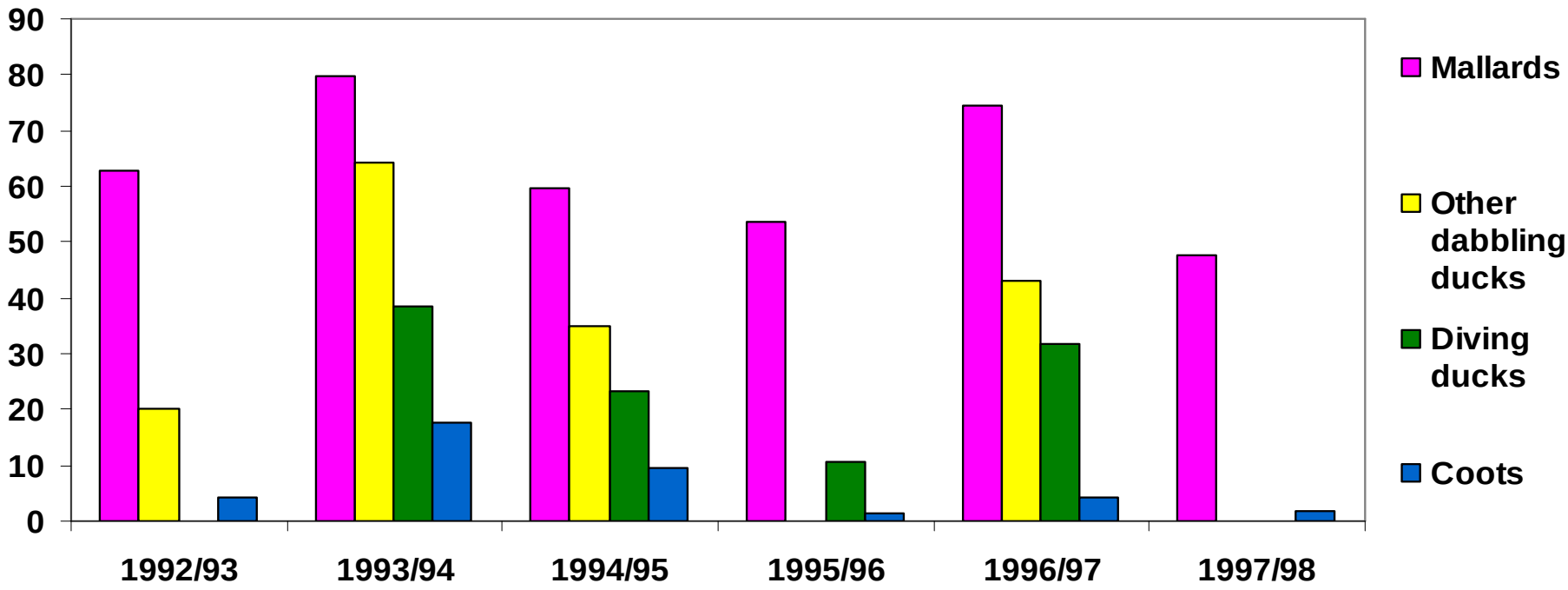
1 - Mallard duck

2 - Other dabbling Duck

3- diving Duck

4 - Coots

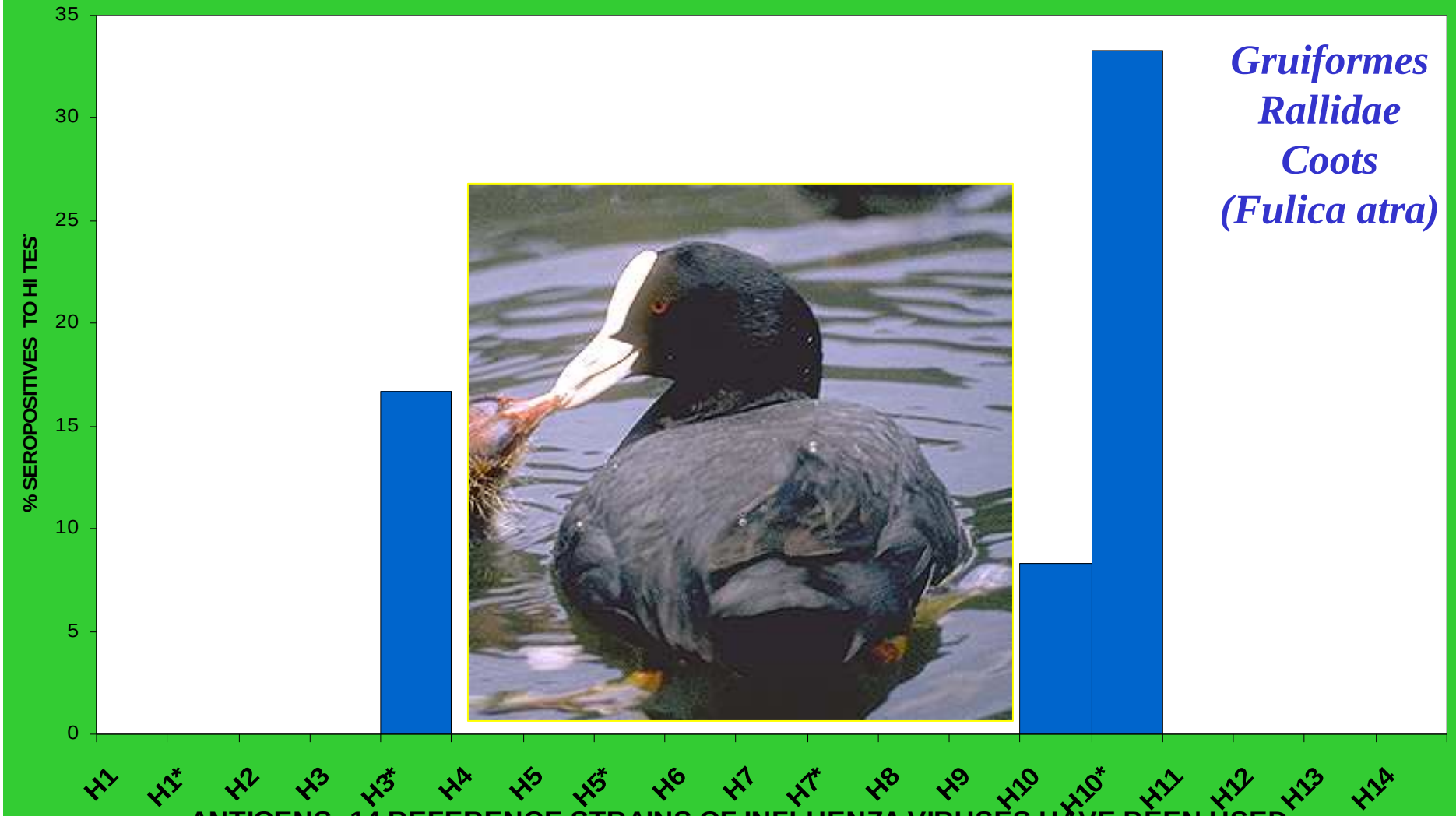
SEROPREVALENCES TO INFLUENZA A VIRUSES IN WINTERING WATERFOWL (N°1040 SAMPLED BIRDS)



Results:
During all years, strong relations are shown in the seroprevalence of the duck groups.

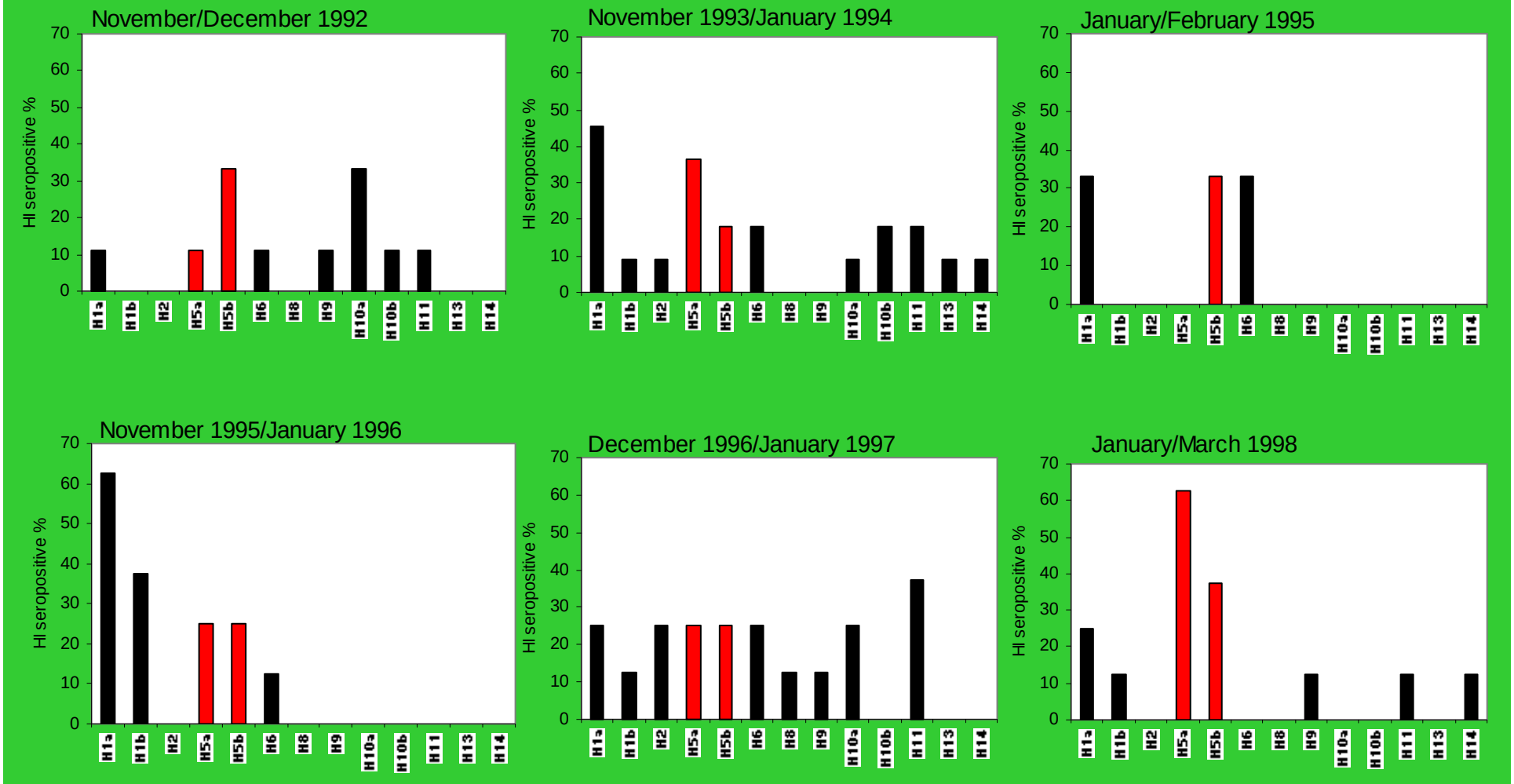
Seroprevalences are higher in adults than young Coots
No differences related to the age were shown in ducks

SEROLOGICAL PERCENTAGE OF COOTS (Fulica atra) FOUND SEROPOSITIVE TO SUBTYPES OF INFLUENZA VIRUSES (1992-1998)
VALUES CALCULATED ON 24 COOTS NP-ELISA POSITIVE

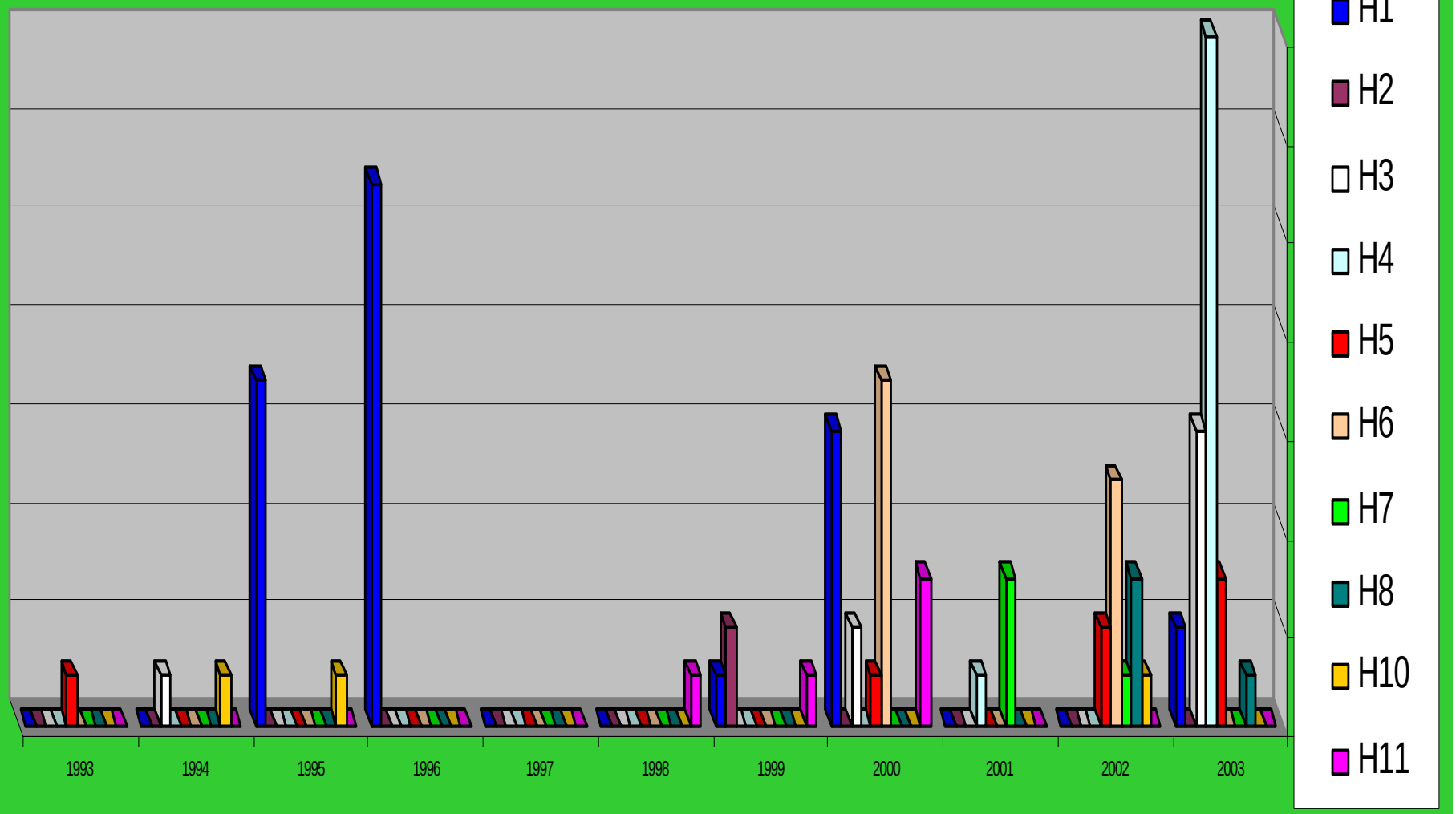


ANTIGENS: 14 REFERENCE STRAINS OF INFLUENZA VIRUSES HAVE BEEN USED (FROM H1 TO H14); 4 VIRUS (H1*, H3*, H5*, H10*) WAS ISOLATED FROM WINTERING WATERFOWL; 1 STRAIN WAS ISOLATED FROM TURKEY: A/TURKEY/ITALY/6423-1/99 (H7N1)

Percentuale di anatre HI-sieropositive, calcolate durante 6 periodi di svernamento (1992-1998) su animali NP-ELISA sieropositivi (N. 47) e con anticorpi verso almeno un sottotipo H (= H5)

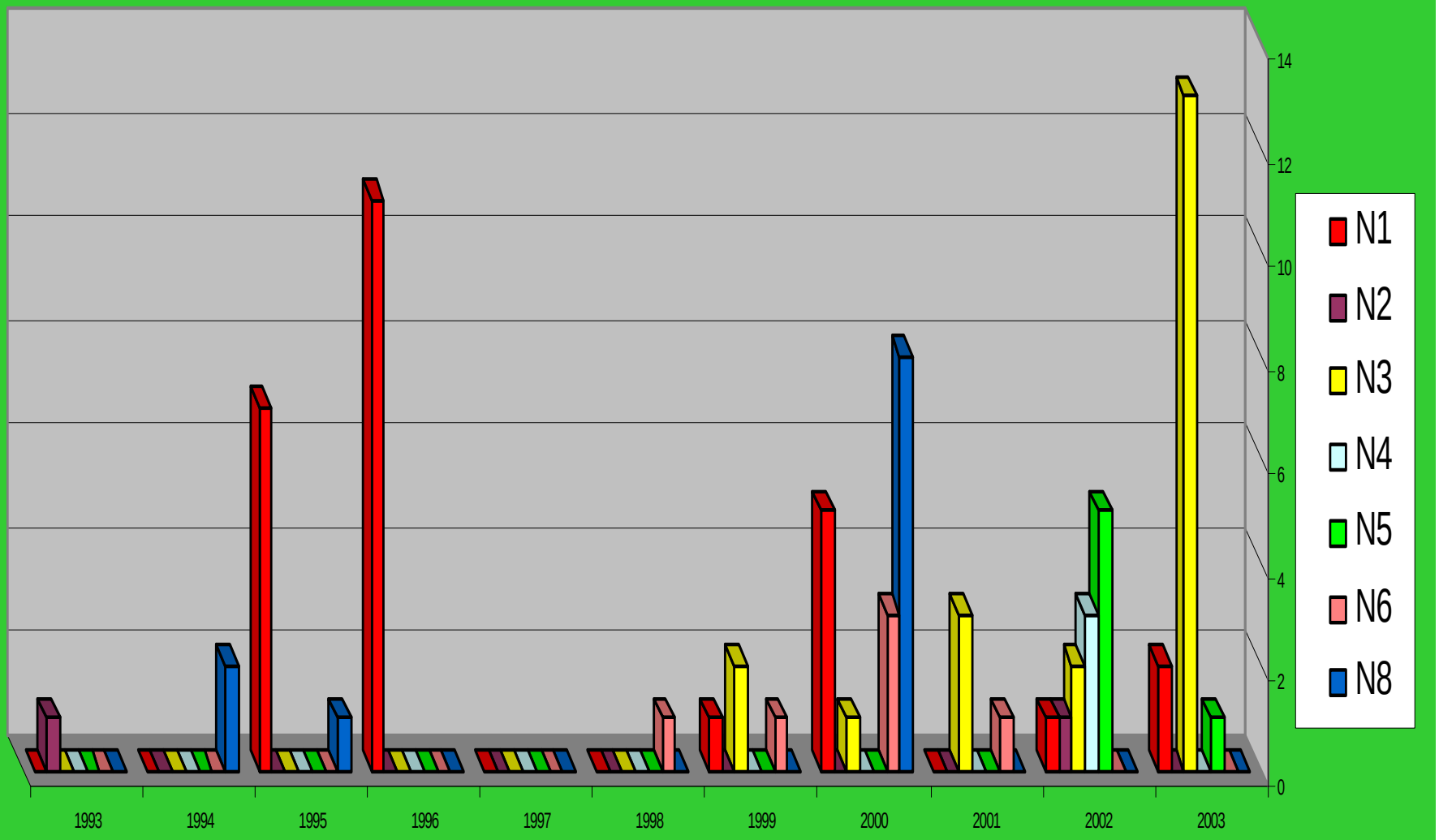


ANNUAL DISTRIBUTION OF HA INFLUENZA SUBTYPES ISOLATED FROM 2524 FERAL DUCKS AND E 582 COOTS IN ITALY (1993-2003)

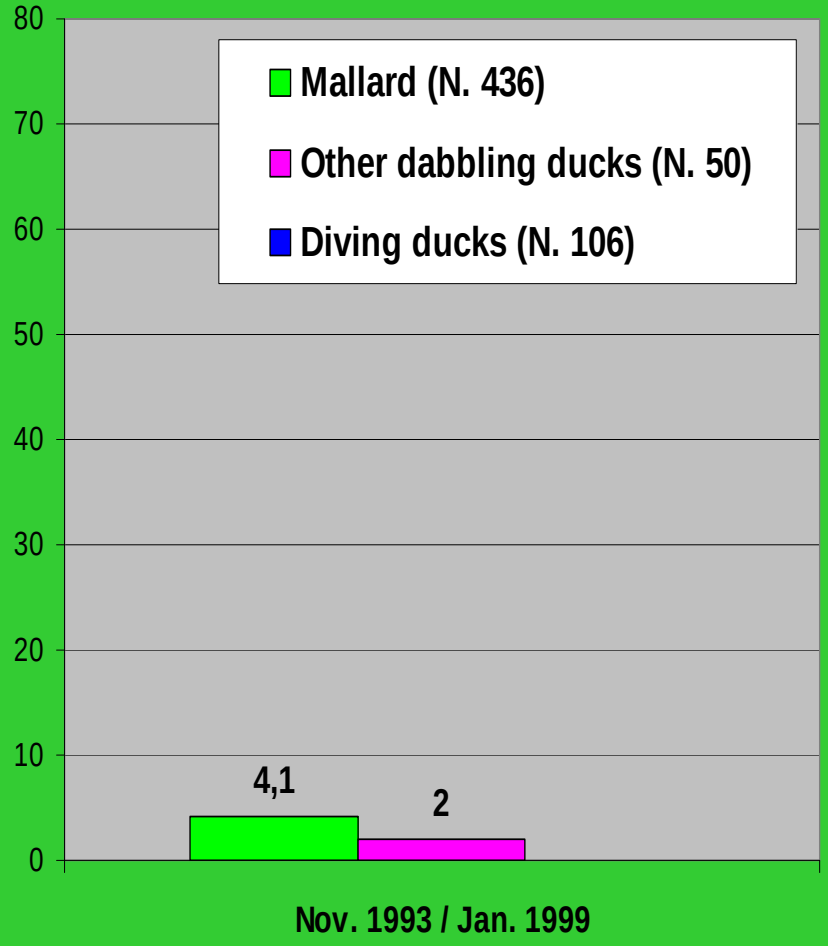


H5N1 19/09/2005
Mirandola (MO)

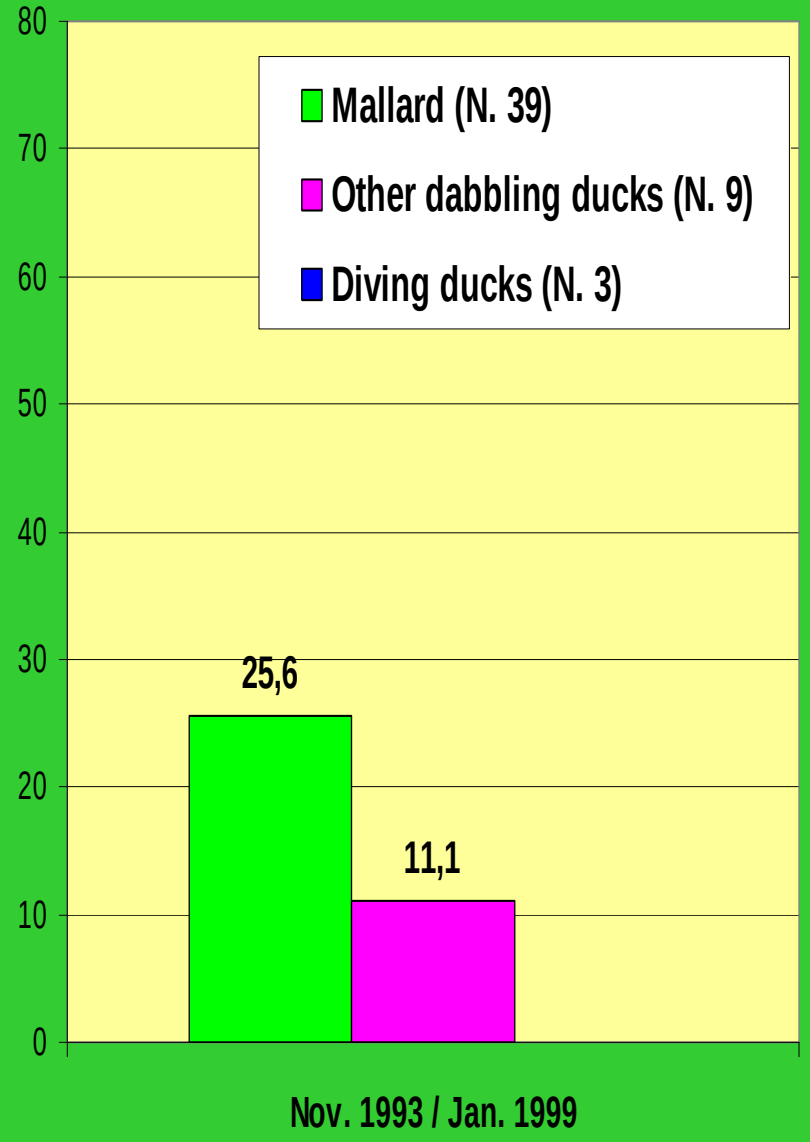
ANNUAL DISTRIBUTION OF NA INFLUENZA SUBTYPES ISOLATED FROM 2524 FERAL DUCKS AND E 582 COOTS IN ITALY (1993-2003)



VIRUS ISOLATION PREVALENCE % IN CAPTURED DUCKS



SEROCONVERSION % IN RECAPTURED DUCKS



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Virology 323 (2004) 24–36

VIROLOGY

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Interspecies transmission of an H7N3 influenza virus from wild birds to intensively reared domestic poultry in Italy

Laura Campitelli,[a,*] Elvira Mogavero,[a] Maria Alessandra De Marco,[b] Mauro Delogu,[c] Simona Puzelli,[a] Fabiola Frezza,[a] Marzia Facchini,[a] Chiara Chiapponi,[d] Emanuela Foni,[d] Paolo Cordioli,[e] Richard Webby,[f] Giuseppe Barigazzi,[d] Robert G. Webster,[f] and Isabella Donatelli[a]

[a] *Department of Virology, Istituto Superiore Sanita', Rome, Italy*
[b] *Istituto Nazionale per la Fauna Selvatica "A. Ghini", Ozzano Emilia (BO), Italy*
[c] *Department of Public Health and Animal Pathology, Faculty of Veterinary Medicine, University of Bologna, Bologna, Italy*
[d] *Istituto Zooprofilattico Sperimentale della Lombardia ed Emilia, Parma, Italy*
[e] *Istituto Zooprofilattico Sperimentale della Lombardia ed Emilia, Brescia, Italy*
[f] *Virology Division, Department of Infectious Diseases, St. Jude Children's Research Hospital, Memphis, TN 38105, USA*

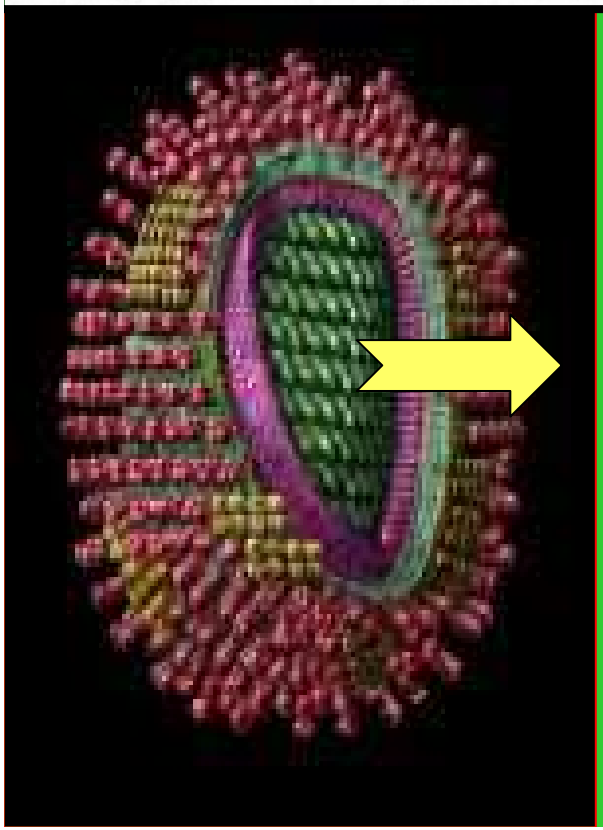
Received 10 September 2003; returned to author for revision 29 October 2003; accepted 17 February 2004

Available online 21 April 2004

October 2001

H7N3

FIRST ANCESTOR



Type A

(8 RNA segments)

-PB1, PB2, PB3

-PA)

4° - HA (Haemoagglutinin)

5° - NP(Nucleoprotein)

6° - NA (Neuroaminidase)

7° - M1, M2 (MatrixProt.)

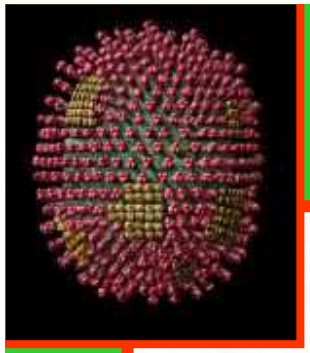
8° - NS .1, NS 2

October 2002

Viruses analyzed in this study

Virus	Subtype	Date of isolation	Location
A/Mallard/Italy/35/99	H2N3	December 1999	Tuscany
A/Mallard/Italy/36/99	H2N3	December 1999	Tuscany
A/Mallard/Italy/208/00	H5N3	August 2000	Tuscany
A/Mallard/Italy/33/01	H7N3	October 2001	Tuscany
A/Mallard/Italy/43/01	H7N3	October 2001	Tuscany
A/Turkey/Italy/214845/02	H7N3	October 2002	Lombardia
A/Turkey/Italy/220158/02	H7N3	October 2002	Lombardia

Note. All isolates were obtained from cloacal swabs. None of the animals from which the isolates were obtained showed any disease signs at the time of sample collection. However, 2 weeks before collection, the two birds that were the sources of A/Turkey/Italy/214845/02 and A/Turkey/Italy/220158/02 had shown mild respiratory symptoms, which were diagnosed and treated as mycoplasmosis.




```
                          30        40        50        60        70        80
Tern/Astr/775/83          H13 AFNAVIHGKVENNKCETTPTTTPHPVYNCSDTVITKNHTTINNITTVVFQDPETHFRLPL
Mallard/It/208/00         H5  IFNTVIHEKIGDHQTVVYPTITAPVVPNCSDTIITYNNTVVNNITTTIITKAEKHFKSSL
Mallard/It/35/00          H2  IFNTVIHEKIGDHQTVVYPTIAAPVVSNCSDTIITYNNTVVNNITTTIITKAEKHFKSSL
Mallard/It/36/00          H2  IFNTVIHEKIGDHQTVVYPTIAAPVVSNCSDTIITYNNTVVNNITTTIITKAEKHFKSSL
Mallard/It/33/01          H7  IFNTVIHEKIGDHQTVVYPTVTAPVVPNCSDTIITYNNTVVNNITTTIVTKAETHFKSSL
Mallard/It/43/01          H7  IFNTVIHEKIGDHQTVVYPTVTAPVVPNCSDTIITYNNTVVNNITTTIVTKAETHFKSSL
Turkey/It/214845/02       H7  IFNTVIHGKIGDHQTVVYPTVTAPVV.......................TKAEPHFKSSL
Turkey/It/220158/02       H7  IFNTVIHGKIGDHQTVVYPTVTAPVV.......................TKAEPHFKSSL
Pigeon/Nan/9-366/00       H3  IFNAVIHEKIGDHQTVIYPTITPPVVPNCSDTIITYNNTVVNNITTTIITKAEKHFKSSL
Bantam/Nan/9-058/00       H3  IFNAVIHEKIGDHQTVIYPTITPPVVPNCSDTIITYNNTVVNNITTTIITKAEKHFKSSL
Duck/Ger/1215/73          H2  IFNTVIHEKIGDHSTVVYPTITTPVVPNCSDTIITYNNTVINNITTTIITEAERHFKPSL
Turkey /Min/916/80        H7  VFNTVIHEKIGDHQTVIHPTIMTPAVPNCSDTIITYNNTVINNITTTIITEAERLFKPPL
RuddyTurnstone/NJ/65/85   H7  IFNTVIHEKIGDHQTVIHPTITTPAVPNCSDTIITYNNTVINNITTTIITEAERPFKPPL
                              ** *** *          **      *                          * * *
```

Fig. 2. Alignment of the NA stalk region of N3 viruses. The full names of virus strains are as indicated in Fig. 4. Potential glycosilation sites are underlined. Asterisks indicate conserved amino acid residues.

LPAI AH7N3

Serological Analysis of Serum Samples from Humans Exposedto Avian H7 Influenza Viruses in Italy between 1999 and 2003

Simona Puzelli,1 Livia Di Trani,2 Concetta Fabiani,1 Laura Campitelli,1 Maria Alessandra De Marco,3 Ilaria Capua,4 Jean Francois Aguilera,5 Maria Zambon,5 and Isabella Donatelli 1

1 Department of Infectious, Parasitic and Immuno-Mediated Diseases
2 Department of Food and Animal Health, **Istituto Superiore di Sanita`**, Rome,
3 Istituto Nazionale per la Fauna Selvatica, Ozzano Emilia, Bologna,
4 Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro, Padova, Italy;
5Centre for Infection, Health Protection Agency, London, United Kingdom

References

1. Puzelli S. et al. Serological analysis of serum samples from humansexposed to avian H7 influenza viruses in Italy between 1999 and 2003. J Infect Dis2005; 192:XXX–XX.

DELTA PO

NATIONAL PARK

Sternidae

Laridae

Ducks / Sea Gulls

These species have frequently interactions

Mallard

Wigeon

Black headed gull

Pintail

Teal

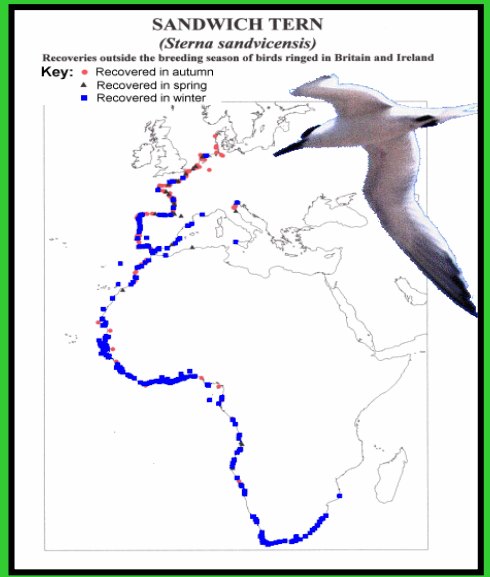
Herring gull

Shoveler

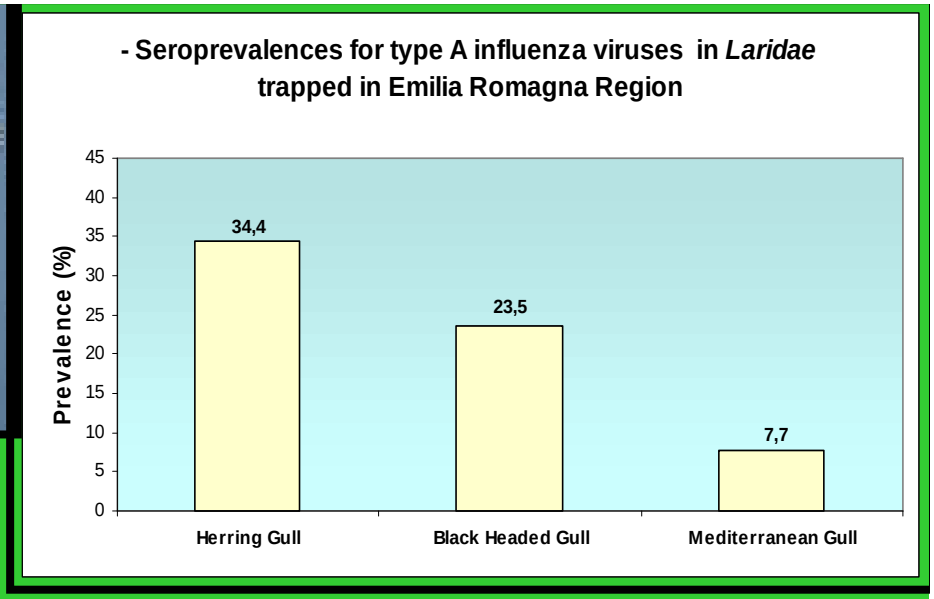
Sternidae

Emilia Romagna Region 2001, Italy Type A seroprevalence

Species	N° esamined	N° Positives	Prevalence (%)
Common Tern	41	1	2,4
Little Tern	13	1	7,7
Sandwich Tern	71	1	1,4
Black Tern	15	2	13,3
Total	140	5	3,6



***(All HI negatives for H5 and H7)**

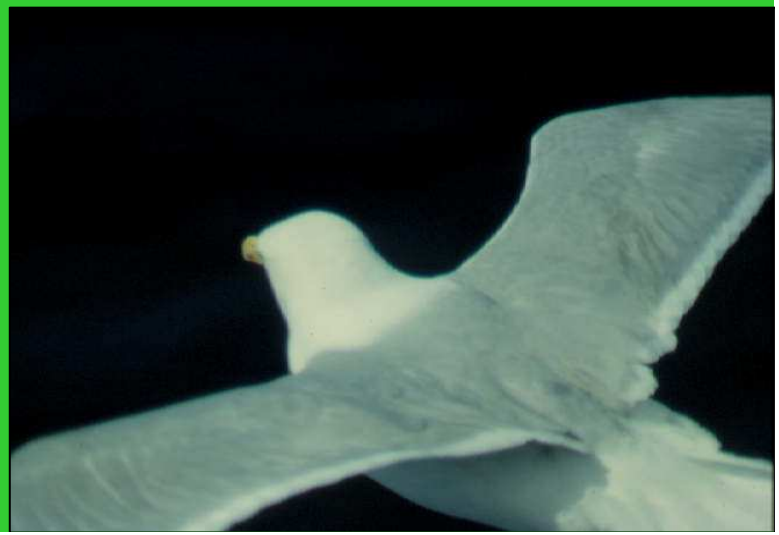


Laridae

Emilia Romagna Region, 2001
Italy, Type A seroprevalence

*One adult of Herring Gull was H7 seropositive

Species	N° esamined	N° positives	Prevalence (%)
Mediterranean Herring Gull *	32	11	34,4
Black headed Gull	17	4	23,5
Mediterranean Gull	52	4	7,7
Total	101	19	18,8



Virological exams
(Italy)
Herring Gull
(Juveniles)
Emilia Romagna Region

in 1999: 64 samples
in 2000: 70 samples
All negatives to Avian influenza virus

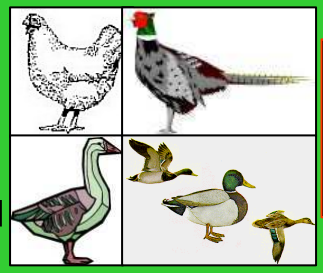
Nestling of Harring Gull

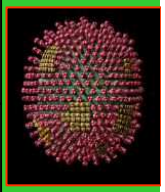

Passeriformes
Sampled in Italian wetlands
Acrocephalus scirpaceus
All cloacal swabs result negative to Avian influenza virus
Passer montanus
Vet. Res. Comm. (De Marco et al, 2003)

Modern Birds

Neognathia

(After Olson, 1985, Feduccia, 1980, 1996, Ericson, 1996, Caspers, Uit de Weerd, Wattel, & de Jong,, 1997, van Tuinen, Sibley & Hedges, 2000, Carcía-Moreno & Mindell, 2000 and van Tuinen, Butvill, Kirsch & Hedges, 2001)





Galloanserae

Neoaves

Neognathia Huxley, 1867 [Neognathe] (neognathous modern birds)

|--o Galloanserae
| |-- Galliformes (fowls, chickens)
| `--o "Anserimorphae" (duck-like birds; sorsamaiset linnut)
| |?- †Dromornithiformes [*sensu*? Murray & Megirian [from Grellet-Tinner, 2001]
| `-- Anseriformes (ducks, swans & geese)
|--o Neoaves
|--o Mesitornithidae Wetmore, 1960 [Mesiornithes Wetmore, 1960])
| |-- *Monias benschi*Oustalet & Grandidier, 1903
| `--o *Mesitornis* Bonaparte, 1855
| |-- *M. variegata*
| `-- *M. unicolor*
`--o Gruimorphae
|?- †*Anisolornis excavatus*
|?- †Diatrymiformes [Neornithes *incertae sedis*]
|?- Gruiformes Bonaparte, 1854 [Grues Bonaparte, 1854] (cranes and relatives)
|?-+-- Phoenicopteriformes (flamingoes;)
| `-- Podicipediformes (grabes)
|?- Charadriomorphae (shorebird-like modern birds;)
|?- "The Land-bird Assemblage"
|?- Eurypygoidea Selby, 1840 [Eurypygae Fürbringer, 1888] (sunbitterns)
|?- Rhynocheti [Rhynochetoidea Sharpe, 1891] (kagut; kagus)
`?- Otides Wagler, 1830 (bustards;)

Most evidence of the monophyly of Galloanserae come from molecular studies, and the group is not well supported by morphological grounds. However, the most recent, although preliminary, phylogenetical analysis of modern birds based on morphology (Livezey & Zusi, 2001, Meyr & Clarke, 2003) seem to confirm the monophyly of Galloanserae.

Galliformes

(Sedentary land based birds)

February/March 1992/93/94

Samples size:

394 Pheasants

(*Phasianus colchicus torquatus*)

trapped in the wild

30 Coming from

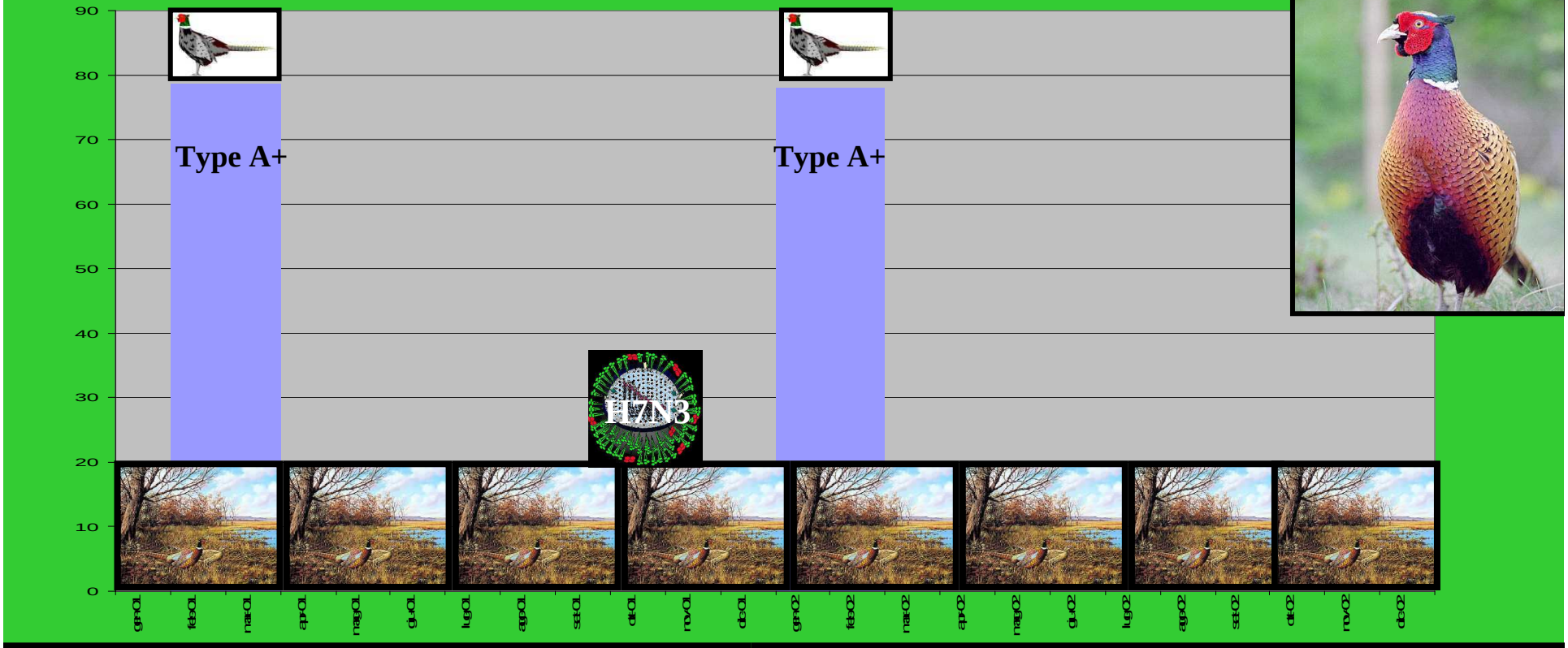
reared groups

All sera were found

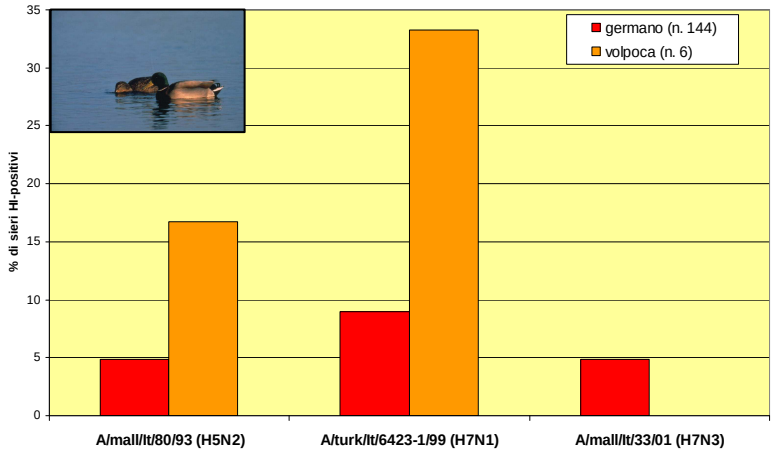
negatives to type A Influenza viruses

(De Marco *et al*, 2003 Vet. Res. Comm.)

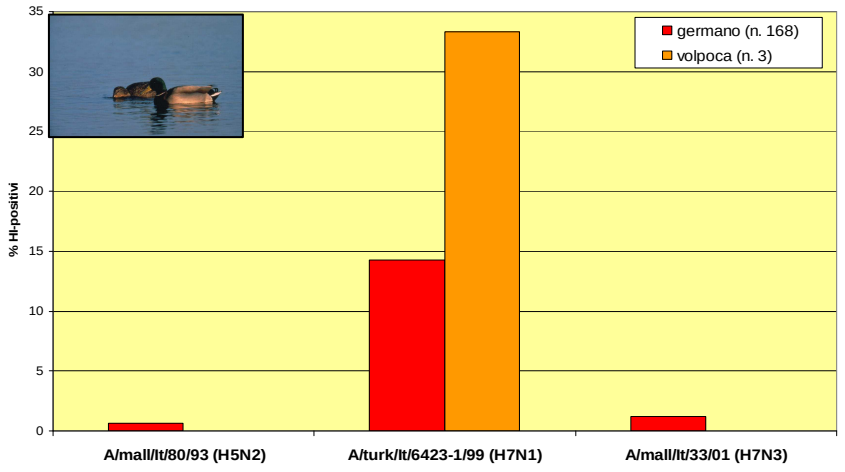
SIEROPREVALENZE PER VIRUS INFLUENZALI DI TIPO A 2001-2002



ANNO 2001: PERCENTUALI DI SIERI DI ANATIDI NP-POSITIVI TESTATI IN HI NEI CONFRONTI DI ALCUNI CEPPI H5 E H7



ANNO 2002: PERCENTUALI DI SIERI DI ANATIDI NP-POSITIVI TESTATI IN HI NEI CONFRONTI DI ALCUNI CEPPI H5 E H7



Owls

- **114 *Owls***

All sera were negative to type A Influenza virus

Birds of prey

- ***33 Birds of Prey***
- ***(Falcons and others)***

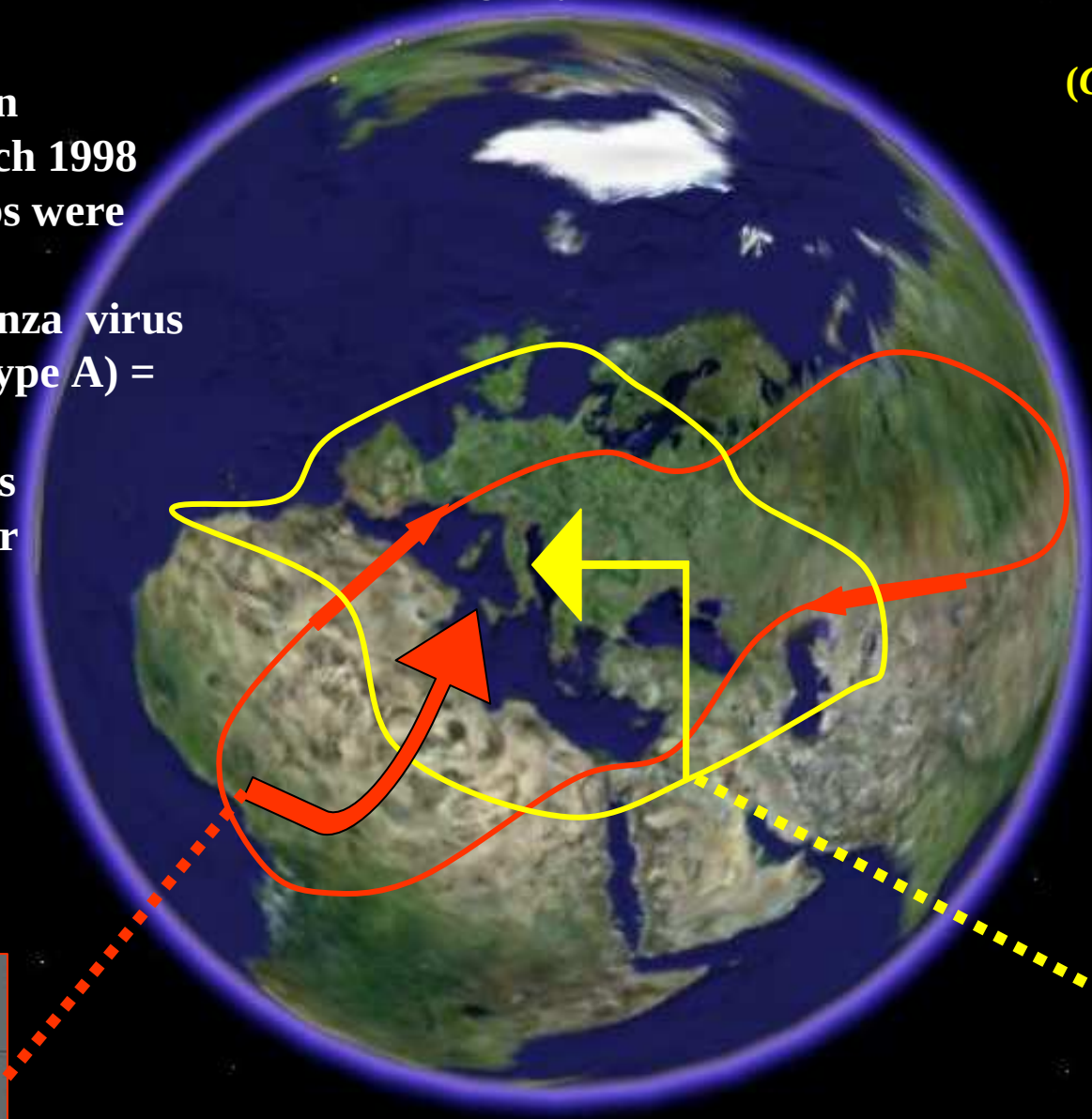
1 Buzzard and 1 Peregrine Falcon were positive to type A Influenza virus

(Vet. Res. Comm. (De Marco et al, 2003)

Trans-saharians migratory duck (Anas querquedula) 126 Garganeys

Trapped in Italian Wetlands in March 1998
126 Cloacal Swabs were negatives
for type A Influenza virus
seroprevalence (type A) = 9.6%
All sampled ducks were negative for the H7 subtype

Transaharian migratory birds:
The Ethiopian Region
Garganeys and Quails



Galliformes
(Migratory land based birds)
Samples size: 258
Quails
(Coturnix coturnix c.)

Trapped in Italy during May 1998

All sera were found negatives to type A Influenza viruses

Focolai e Censimenti aerei….

Ministero della salute: Ordinanza del 11/02/2006

MISURE URGENTI DI PROTEZIONE PER CASI DI INFLUENZA AVIARIA AD ALTA PATOGENICITÀ

NEGLI UCCELLI SELVATICI

ZONA DI PROTEZIONE:

ABBATTIMENTO E DISTRUZIONE DEGLI ANIMALI SENSIBILI INFETTI, SOSPETTI DI INFEZIONE E DI CONTAMINAZIONE

ne trovate qualcuno in questa immagine?

Circolare del Dipartimento della Sanità pubblica vet. *15 Febbraio 2006*

Agonizzanti…ovvero S*tato preagonico*

autorizzato dai Serv. Vet. Locali senza il rispetto della precedente procedura…ma con

Ordinanza del Sindaco su parere favorevole dei Serv. Vet. Locali sentite le unità di crisi regionali e locali

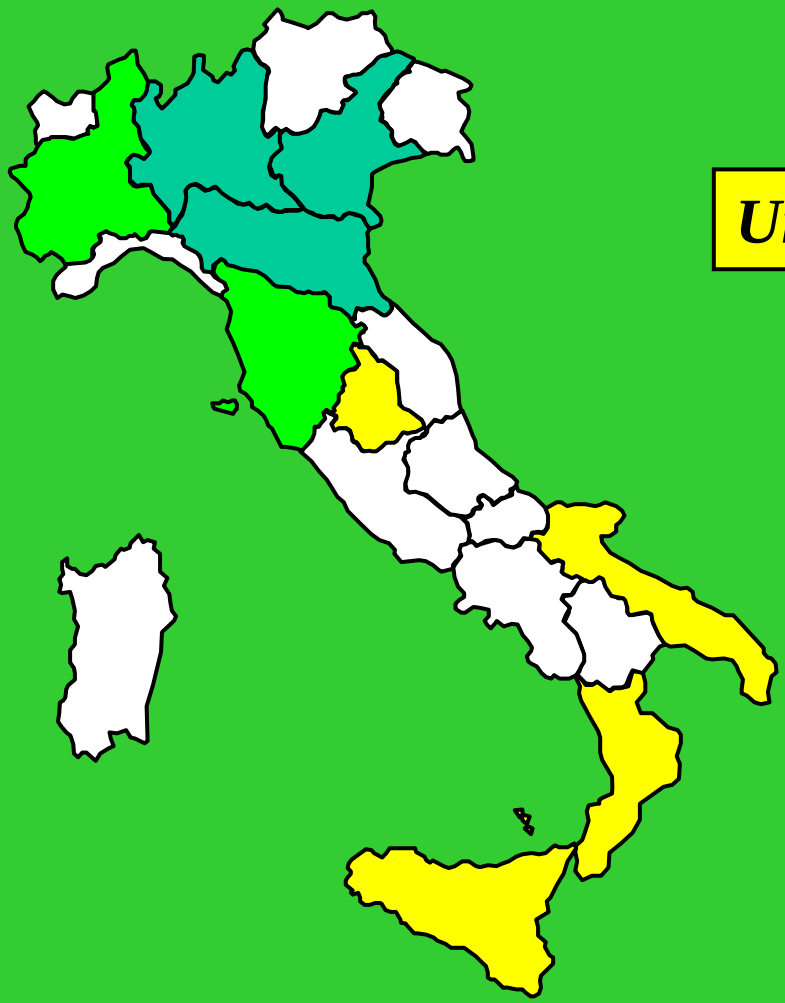

Why to kill?


The Anas castanea example

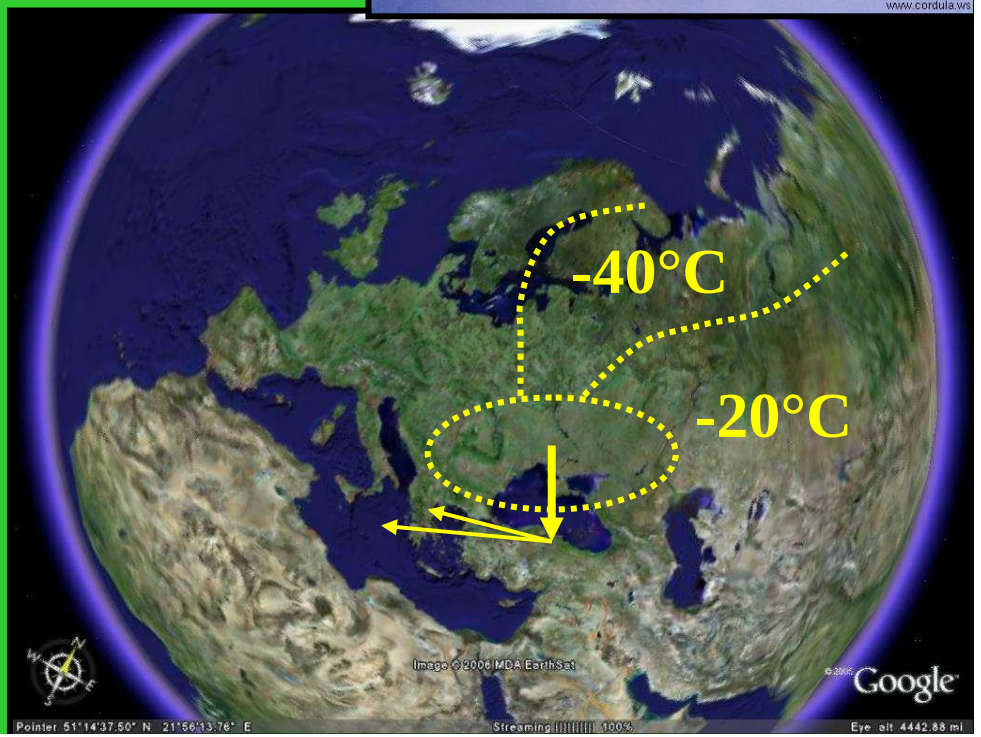
Risk Areas?
Theoretical…..

?

Out breeding and wandering birds



Unpredictable



Avian Influenza Surveillance Program (Wild)

Why (monitoring wild birds)?
and Why not?(*Sentinel ducks, Fecal dropping)*
when, why

Environmental viruses

Viral resistance : (from Stallknecht, 1999/ 2006)

Drinking water : 4 days at 22℃

30 days at 0℃

Distilled Water : 102 days at 28℃

207 days at 17℃

Experimental conditions : 9 days at 28℃

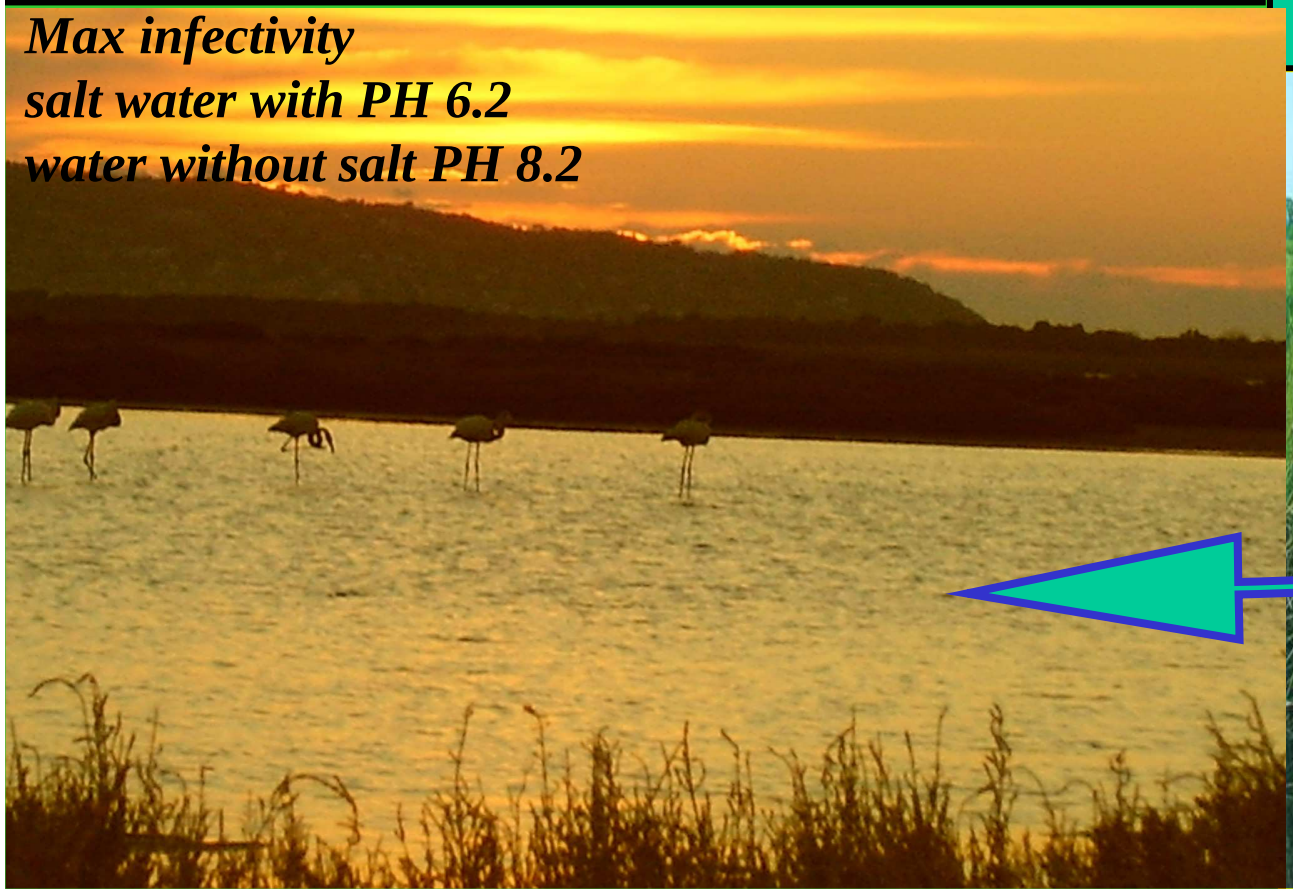
100 days at 17℃

Viral resistence in Faeces:

35 days at 4 ℃,7 days at 20 ℃

(data from Webster)

Max infectivity
salt water with PH 6.2
water without salt PH 8.2



Hunters

Hunted birds

Hunter's and health risk

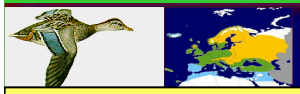
dogs

Decoys

What can the virus see watching the Europe?

Reservoir

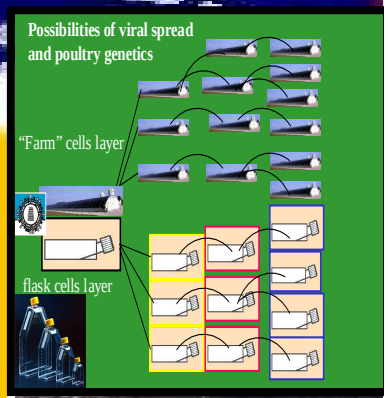
Epiphenomena



Wild ducks 7.5 mil. susceptible/year

In all the Palearctic (50.000 in Italy)

Aquatic birds 23.5 mil.
(230 species In all the Palearctic)



Potential Domestic Reservoir:
9.2 mil. (7 million of raised Ducks) /year.
90% of these ducks are reared in the Lombardia and Veneto Italian Regions.

Domestic Epiphenomena : 4 Billion
Susceptible host/year in Europe,
over 560 milion/year in Italy

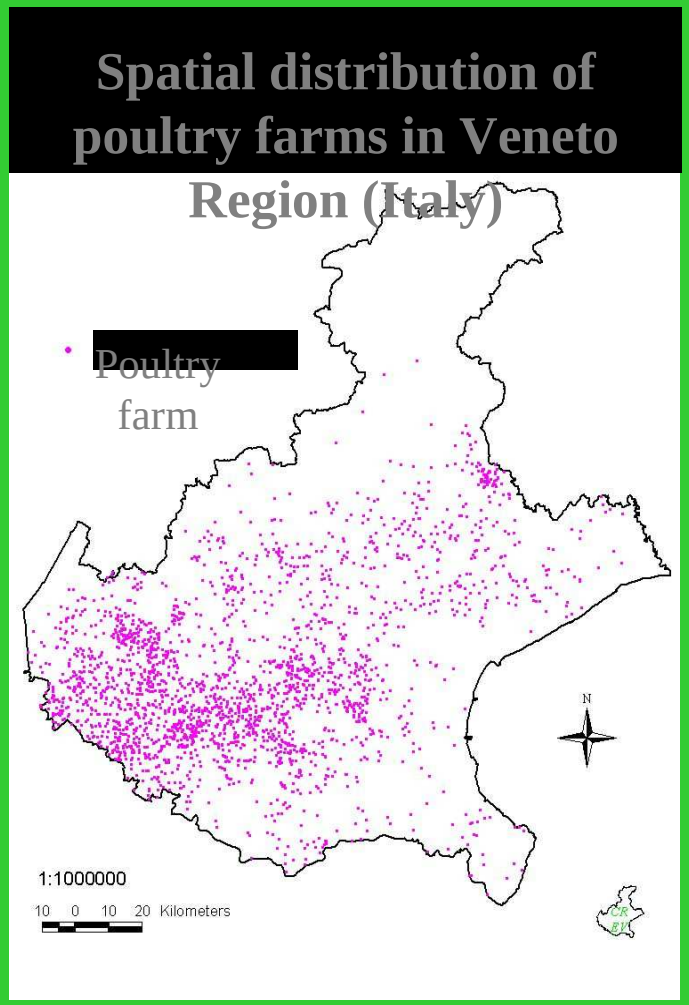
Dispersione della popolazione avicol

3.300 allevamenti avicoli

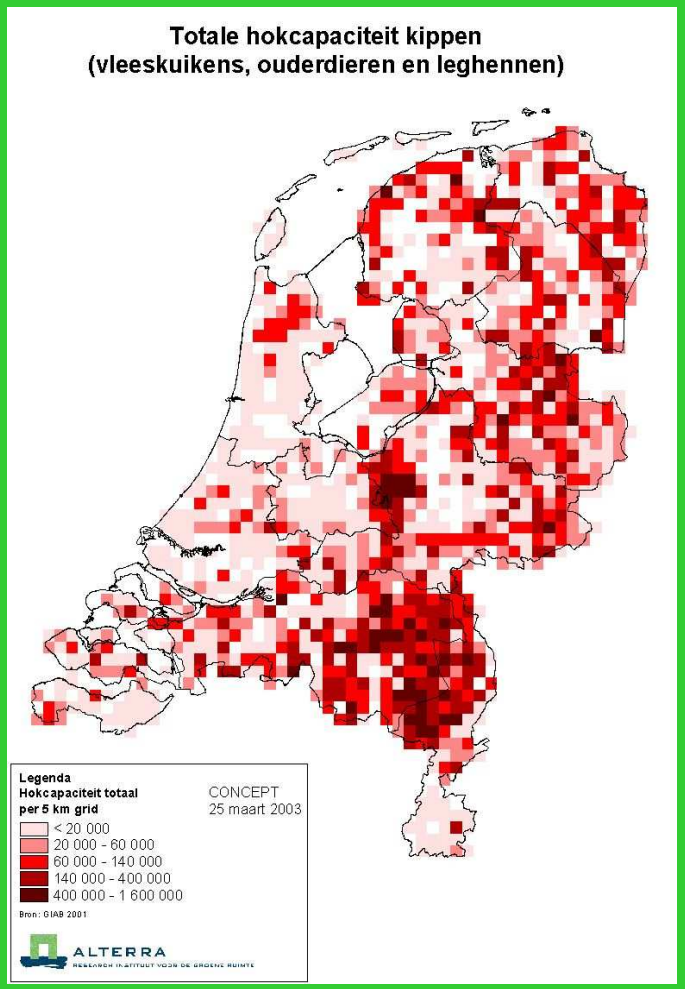
95 milioni di volatili accasabili / ciclo

65% della produzione avicola nazionale

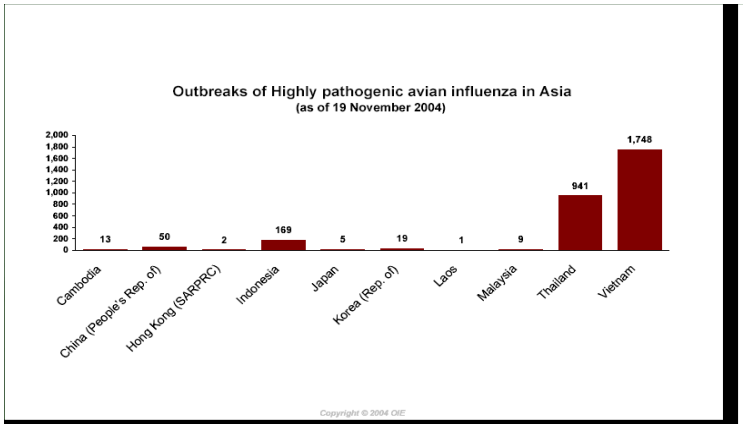
Aree ad alta densità avicola in Europa



12 allevamenti /km^2 (provincia di Verona)



Olanda (Geldersvalley) 20-25 allevamenti


Outbreaks of Highly pathogenic avian influenza in Asia
(as of 19 November 2004)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
13
50
2
169
5
19
1
9
941
1,748
Cambodia
China (People's Rep. of)
Hong Kong (SARRC)
Indonesia
Japan
Korea (Rep. of)
Laos
Malaysia
Thailand
Vietnam
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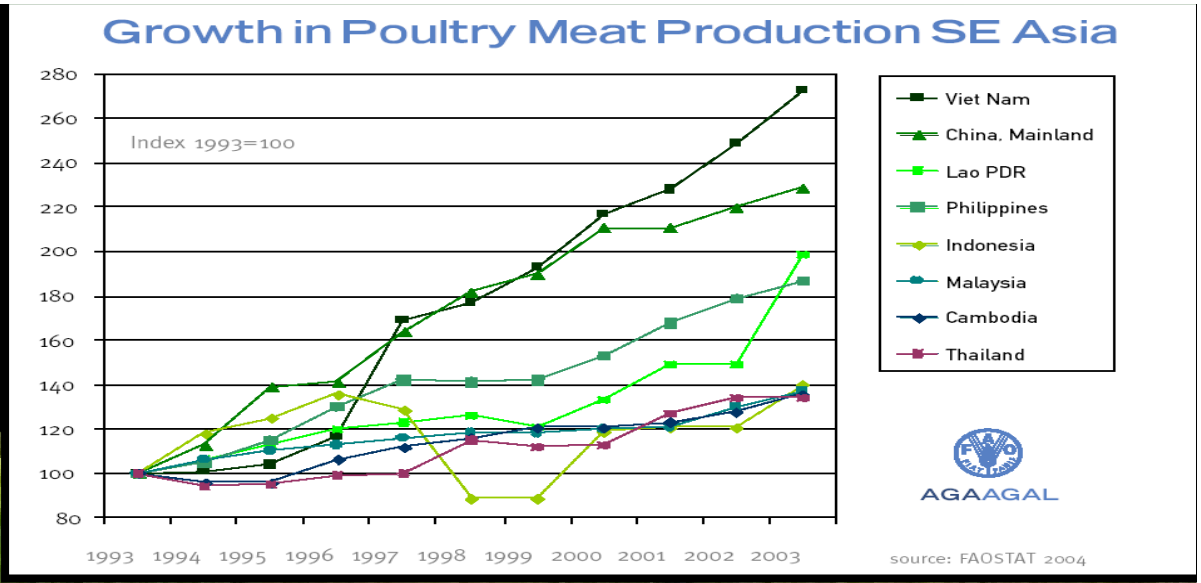
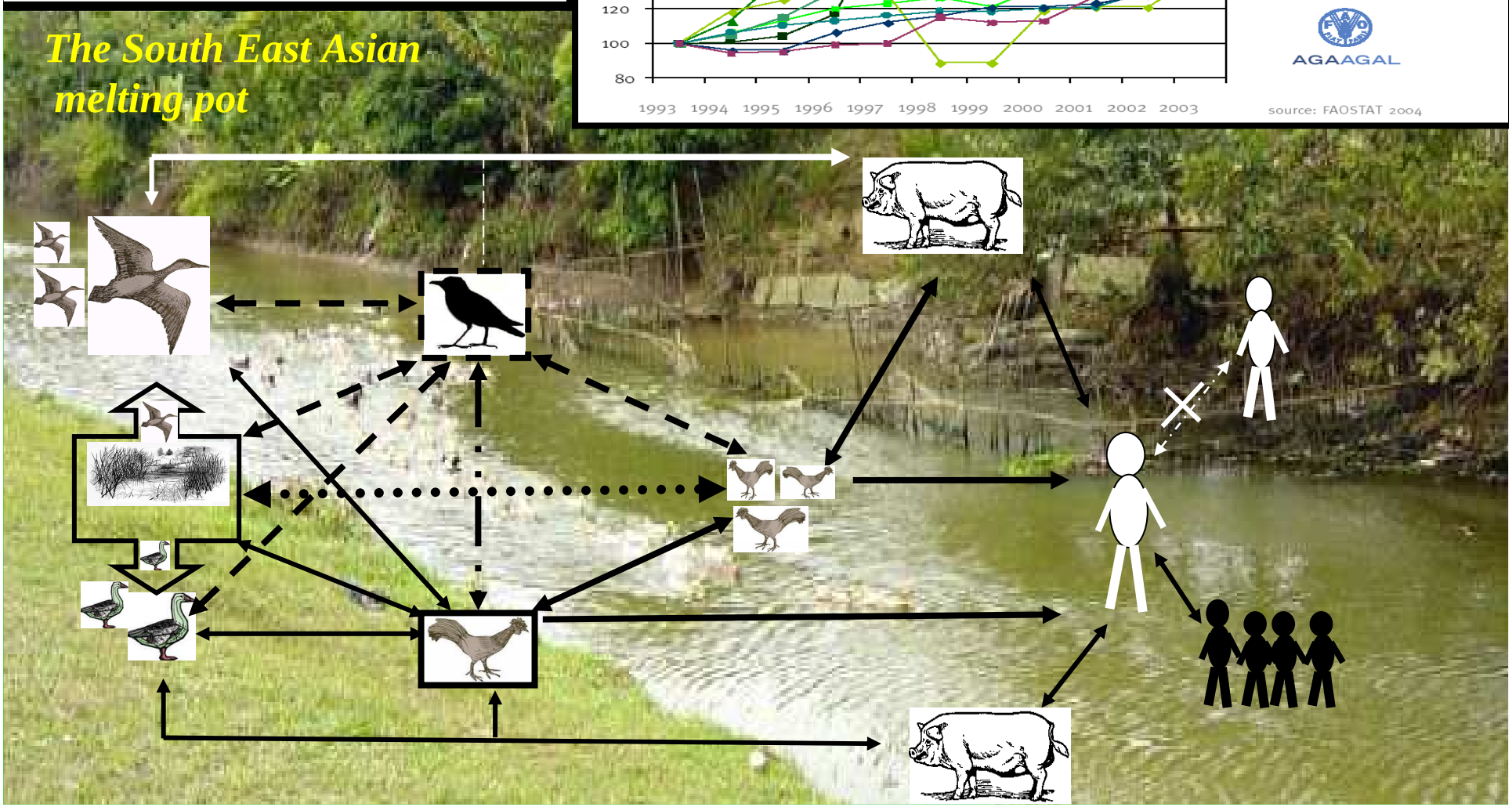
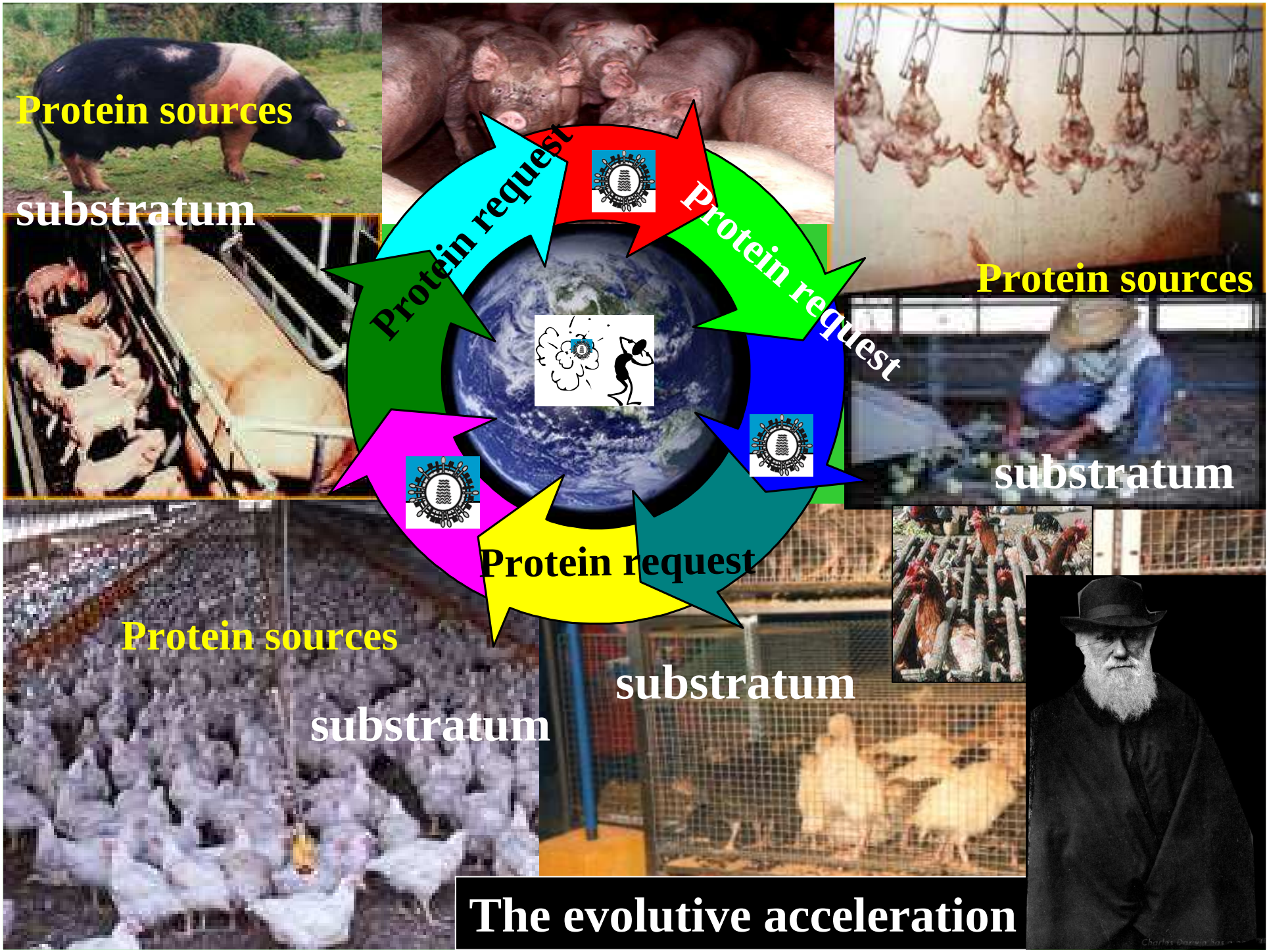
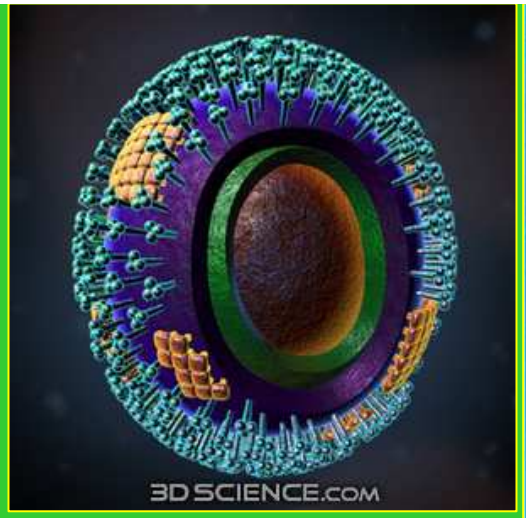
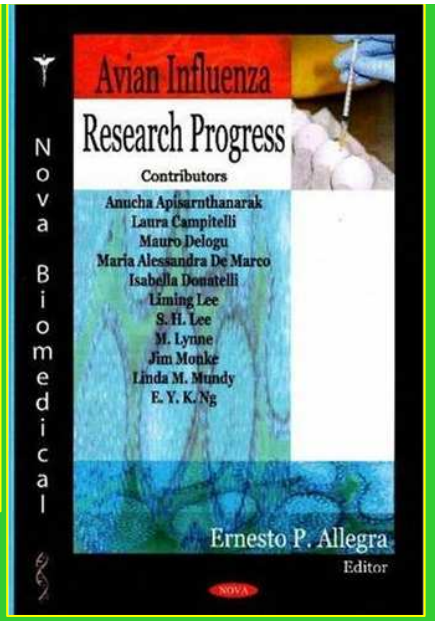

Growth in Poultry Meat Production SE Asia
Index 1993=100
280
260
240
220
200
180
160
140
120
100
80
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Viet Nam
China, Mainland
Lao PDR
Philippines
Indonesia
Malaysia
Cambodia
Thailand
AGAAGAL
source: FAOSTAT 2004


The South East Asian
melting pot


Protein sources
substratum
Protein request
Protein request
Protein request
Protein sources
substratum
Protein sources
substratum
substratum
The evolutive acceleration

The Research Group





Dipartimento di Sanità Pubblica Veterinaria e Patologia Animale Università di Bologna. M. Delogu, Italy

***OMS National Influenza Center*, Istituto Superiore di Sanità (I. Donatelli, L. Campitelli, L. Di Trani) Italy**

M.A. De Marco - Istituto Nazionale per la Fauna Selvatica Italy

Istututo Zooprofilattico Sperimentale della Lombardia ed Emilia Romagna (G. Barigazzi, P. Cordioli, E. Foni, F. Marzadori, P. Massi, E. Raffini, P. Tozzoli) Italy

WWF Italia (M. Carsughi, A. Canu, L. Calchetti**,) Italy**

R.G. Webster (St. Jude Children's Research Hospital, Memphis, Tennessee, USA)