



AGENCE FRANÇAISE  
DE SÉCURITÉ SANITAIRE  
DES ALIMENTS

# **Surveillance of West Nile virus infection in Europe: assessment and improvement axes**

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# Surveillance of West Nile disease in Europe

## Context

Virus

Transmission cycle

Clinics

Diagnostics

Treatment / Prevention

## Surveillance of West Nile virus infection

USA

Europe

## West Nile fever

## I. Context : 1. Virus

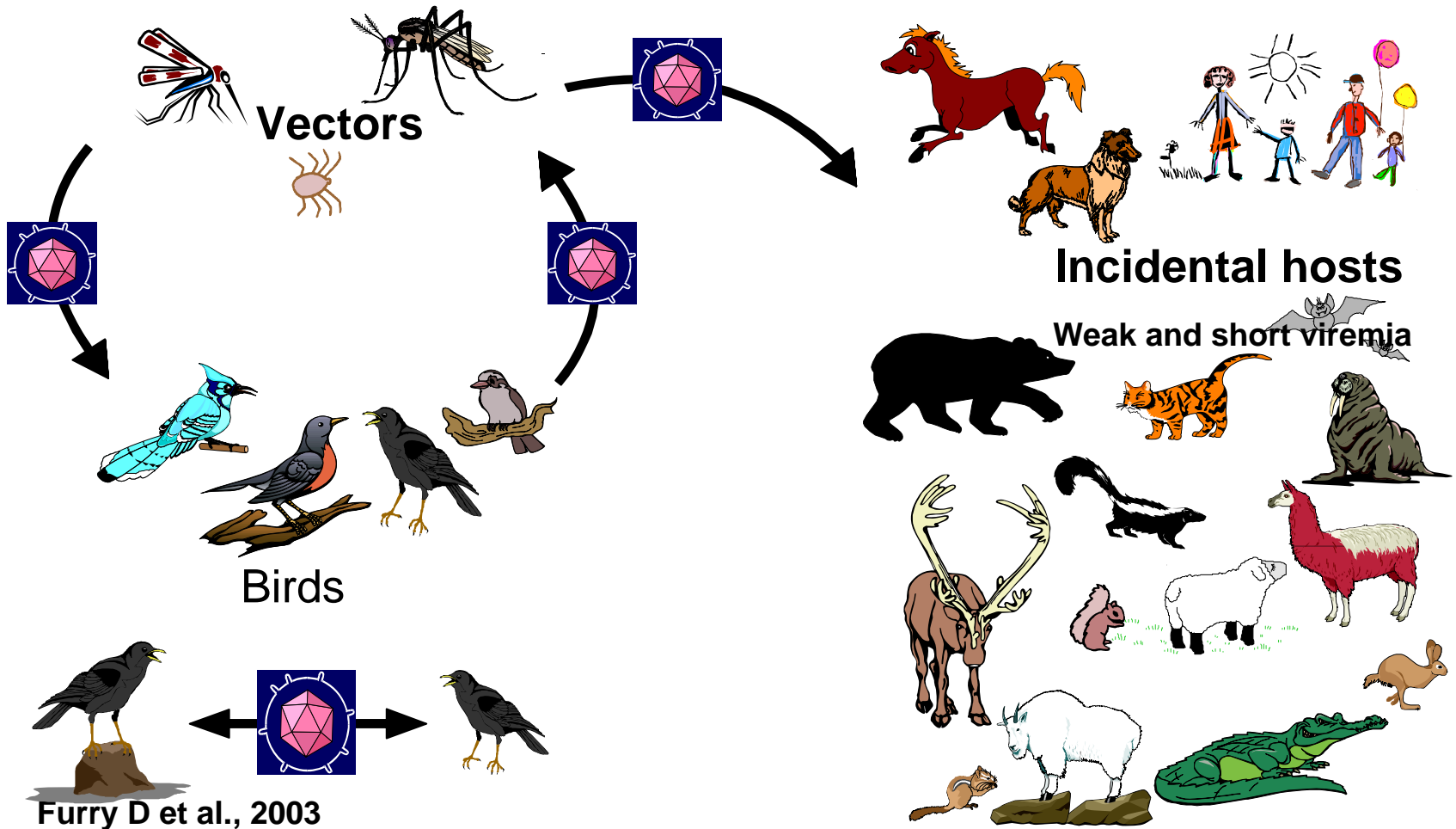
□ Family:	<i>Flaviviridae</i>		
□ Genus:	Flavivirus	Hepacivirus	Pestivirus
□ Examples :	Yellow fever virus Dengue virus	Hepatitis C virus	BVDV

## Major members of the Japanese encephalitis serological group

	Serocomplex	Virus	Geographic distribution	Syndrome
Mosquitoes	Dengue	Dengue type-1 Dengue type-2 Dengue type-3 Dengue type-4	Tropics	Fever Hemorrhagic fever
	Japanese encephalitis	Japanese encephalitis West Nile Saint Louis encephalitis	South Asia worldwide America	Meningitis Encephalitis
	Yellow fever	Yellow fever	Africa South America	Hemorrhagic fever

CROSS REACTIONS

## 2. Transmission cycle of WNV



### 3. Clinical signs

Incubation : 3-15 days

Asymptomatic infection (70 %)

Mild symptoms (20 %)

Fever, weakness, myalgia, ataxia

Neuroinvasive forms (1-10%)

Meningitis, encephalitis, paresis

Motor neurons infection and flaccid paralysis

Letality : 20-57% (horses), 10% (humans)

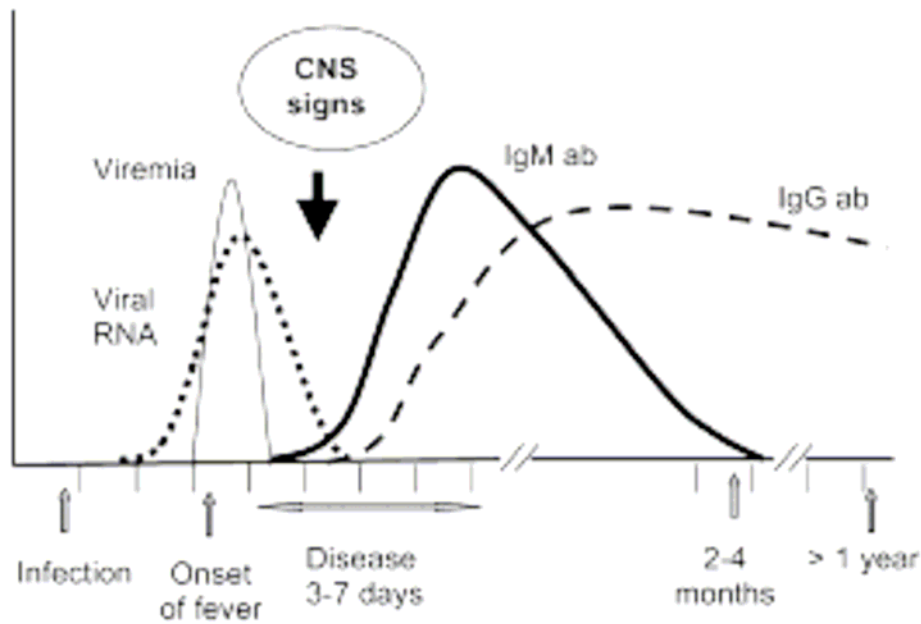
**M. Long**

**Kramer LD. et al, Lancet Neurol, 2007**



Absence of symptoms or non pathognomic symptoms

## 4. Diagnostics

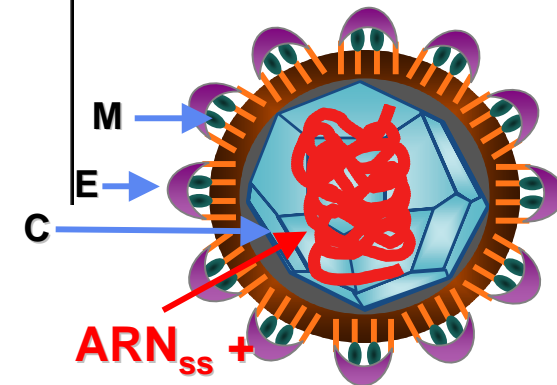


Serology

ELISA (IgM, IgG)  
Seroneutralization tests

Virology

Virus isolation  
RT-PCR (classical or real-time)  
Antigen detection (immunohistochemistry,...)



## 5. Prevention

Vaccine for horses (only available in the USA): inactivated, poxvirus-vectored or yellow fever virus-vectored (Chimerivax)

Intervention on mosquito breeding sites, protection against mosquito bites (long clothes, insecticides)

Poor prevention methods, no available treatment

### Importance of surveillance strategies

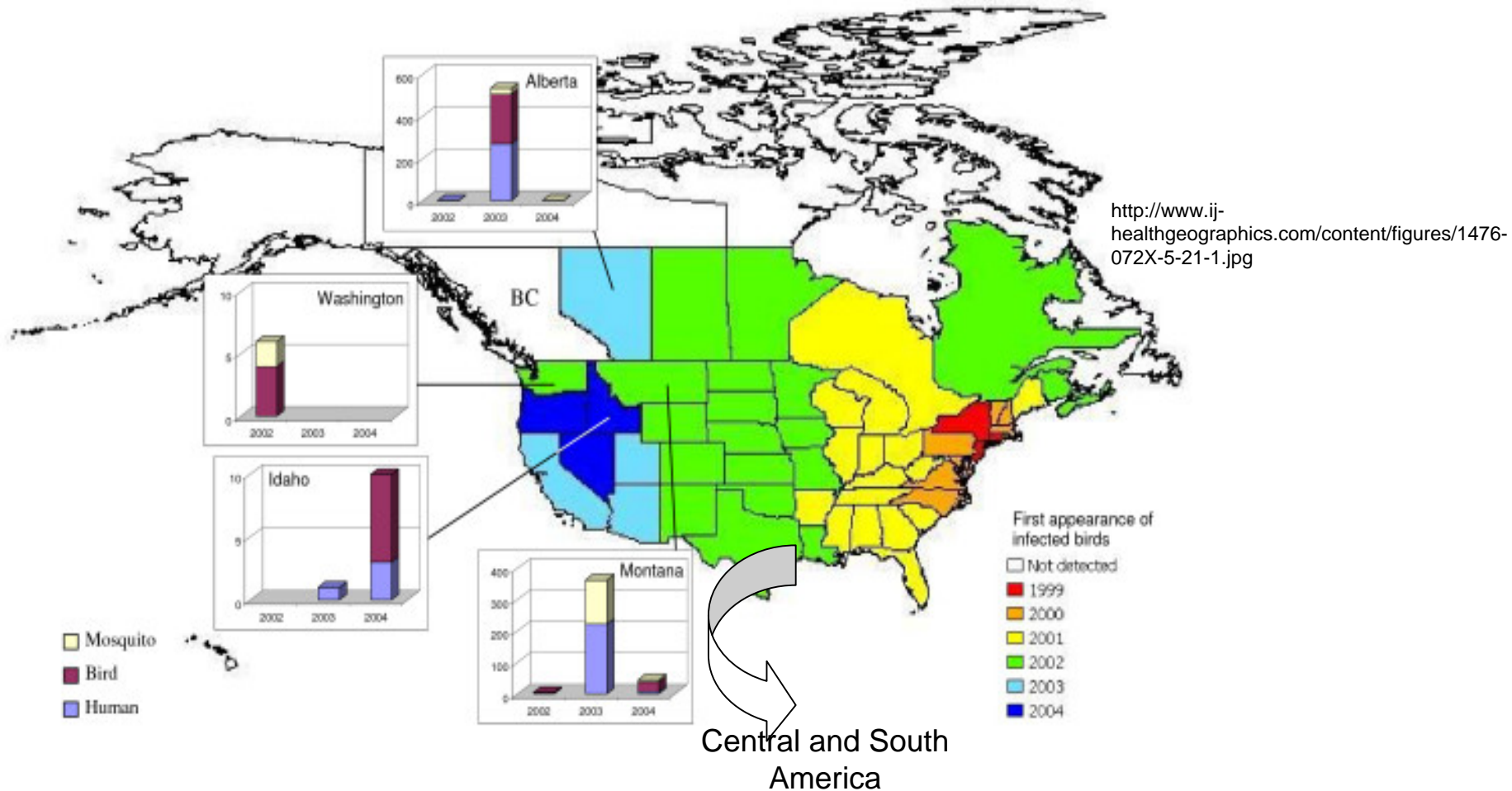
Objectives = to provide decision makers and professionals in human and animal health with relevant and updated information on levels of WNV circulation, so as to take appropriate information and prevention measures in order to reduce the incidence of WN clinical cases.

Multi-species surveillance : humans, equids, birds, (mosquitoes)

Passive surveillance : clinical diagnosis of WNV infection in horses or in humans, analysis of enhanced bird mortality rates

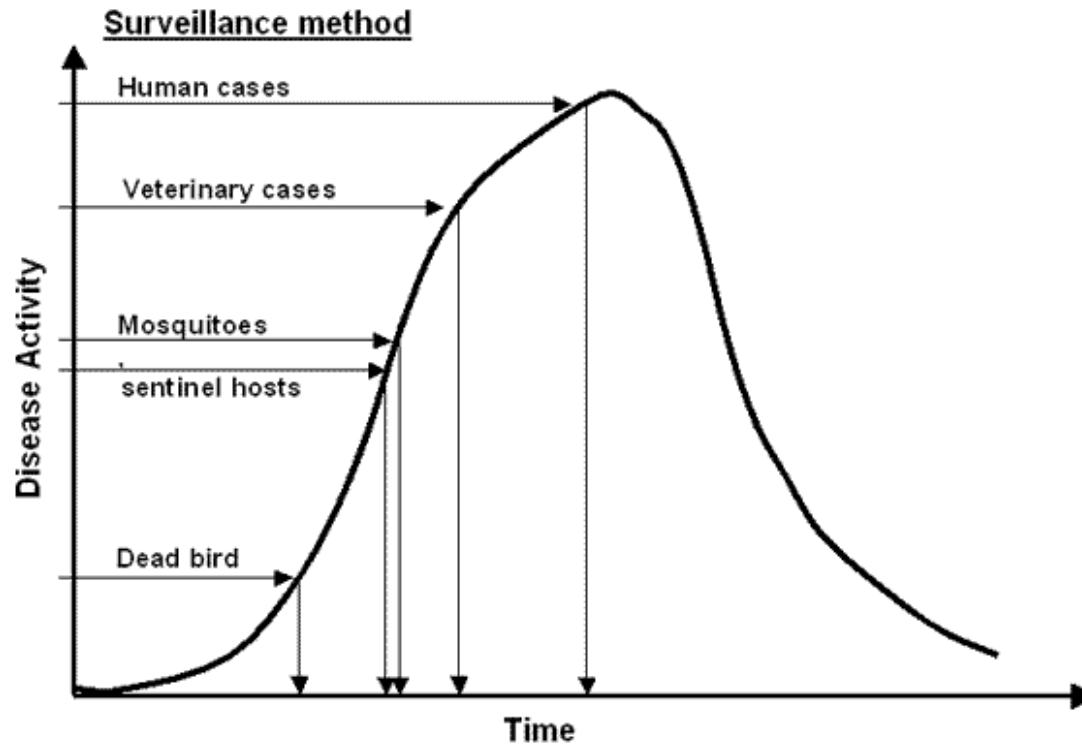
Active surveillance : development of a specific epidemiological network for prospective WN virus and/or WN virus-antibody detection in birds, horses,...

## II. Surveillance of WNV infection in the USA



USA (1999-2007) : >23000 equine cases (2002 : nearly 10000 cases)  
 1,5-3,4 millions human WNV infections – 1200 neuroinvasive forms per year (19-2863) – 116 deaths (2-284)  
 High bird mortality rates (LaDeau SL et al., Nature, 2007)



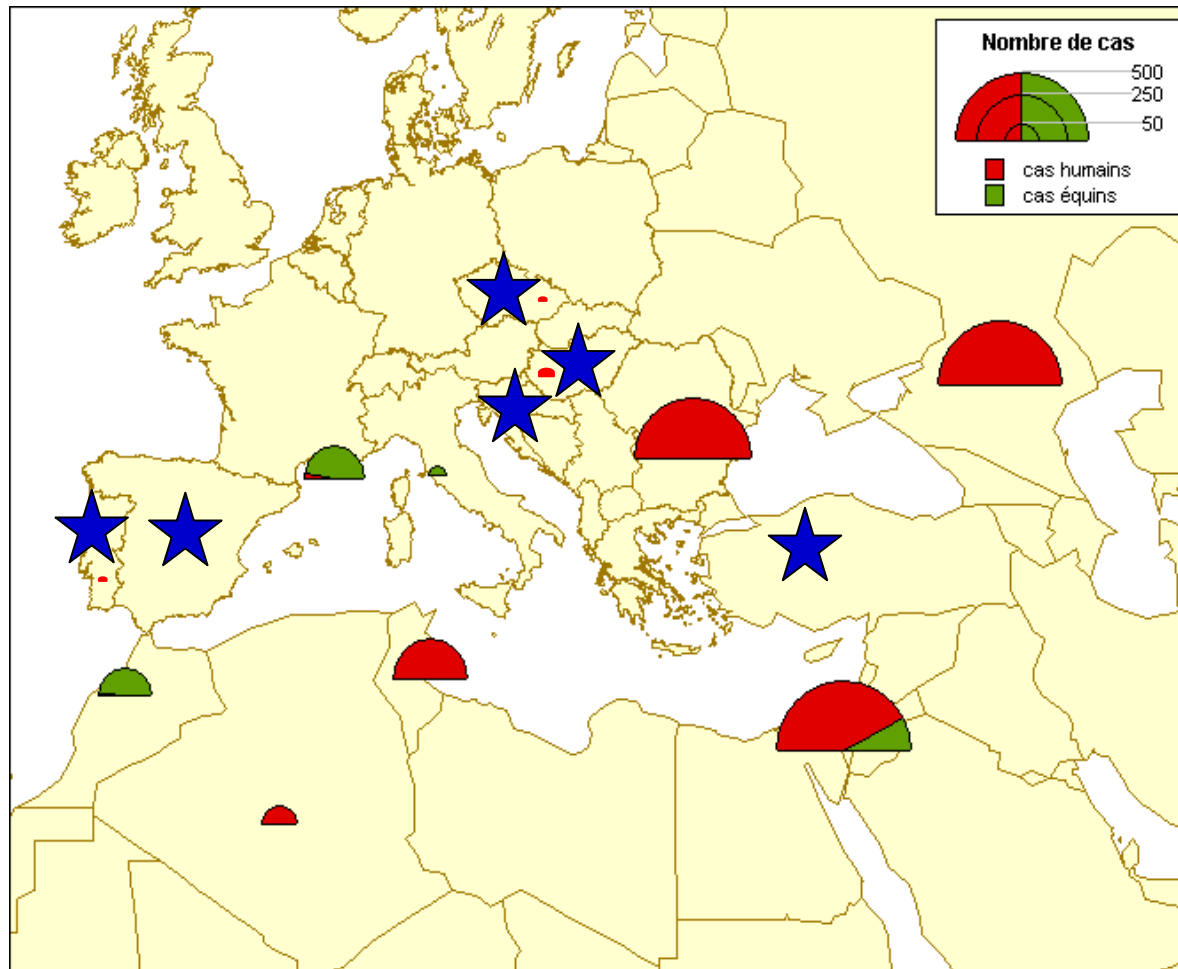


Sensitivity of surveillance methods for WNV circulation in USA (CDC)

Context of intense WNV circulation and symptomatic infections in humans, horses and birds :

Most of alerts (95%) for WNV circulation were launched after passive detection : bird mortality (2/3), horse case (1/3)

## II. Surveillance of WNV infection in Europe



Dauphin G et al.,  
Virologie, 2006

Reemergence in Europe in the 1990s

## WNV circulation in 2008 :

### Italy (Emilia-Romagna province, Ferrara):

20 cases in horses (14 farms) (passive surveillance : notification of neurological symptoms in horses; active surveillance implemented)  
wild birds = 6 crows, 7 magpies (active surveillance)  
2 human cases (passive surveillance)

### Romania (Braila county):

1 human case (passive surveillance)

### France (Guadeloupe Island) :

14 seroconversions in horses (13 confirmed) (active surveillance)  
No human or equine case associated with WNV circulation

# Assessment of surveillance methods for identification of WNV circulation

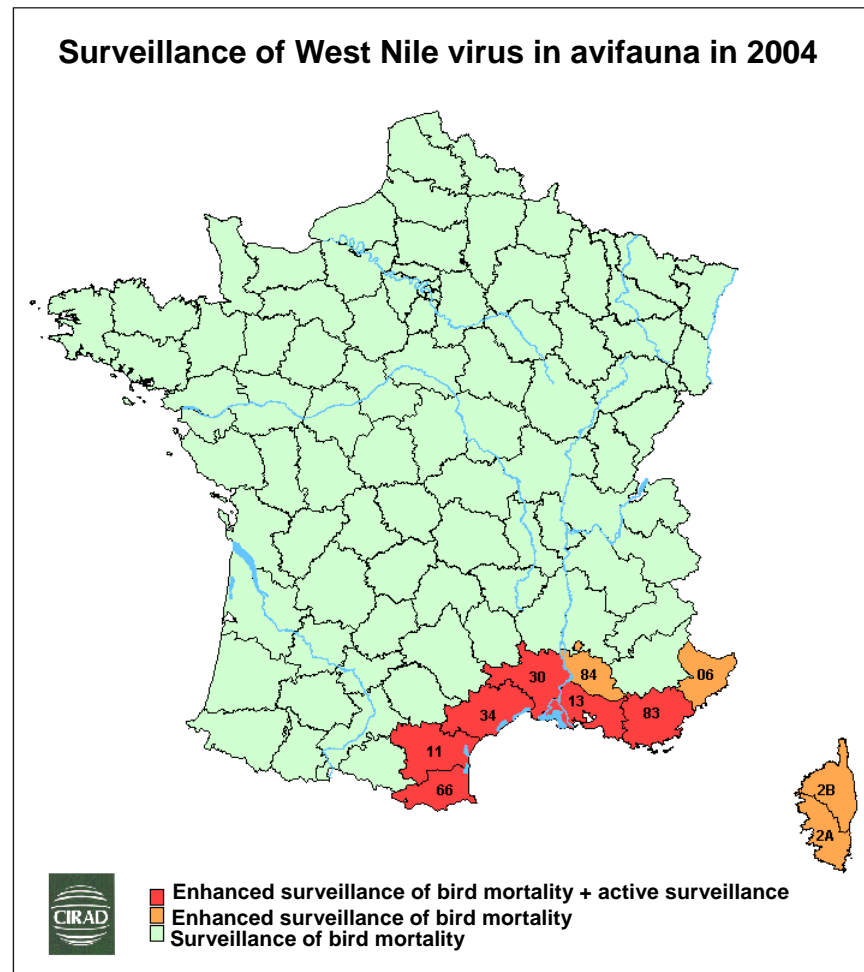
Passive surveillance : good cost/efficacy ratio

Bird mortality = difficulties inherent to the rare bird mortality in Europe and the collection of a sufficient number of dead birds; this latter aspect has been stimulated since connection of WNV surveillance with influenza surveillance or by public information.

Equine clinical cases = regulated reporting to animal health authorities; good sensitivity, concomitant or a bit earlier than the reporting of human cases.

Human clinical cases

Surveillance of bird mortality in 2004 in every French department, with enhanced surveillance in the 10 Mediterranean departments (SAGIR network, virological diagnostics at the French Reference Center for Arboviruses)



## Active surveillance :

Bird seroconversion (ducks, fowls) = good sensitivity (Romania, France), limited by logistics and technical difficulties. Difficult to set a critical level above which clinical cases would be likely to occur.

Horse seroconversion = technically easy. Has allowed for the identification of WNV circulation in the Caribbean (Guadeloupe).

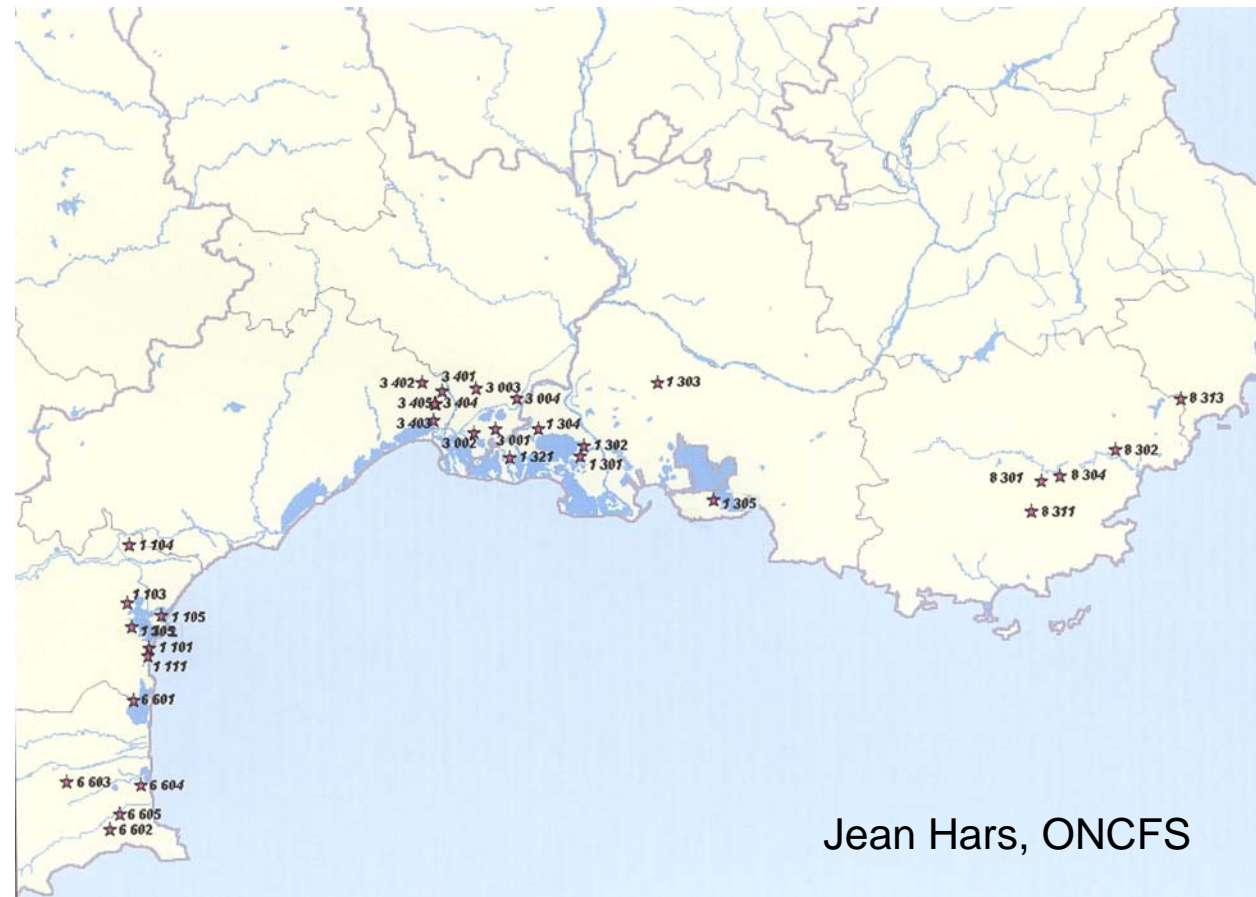
Mosquito capture = not an early warning system (costly, technically difficult,...). Interesting to approach the epidemiological cycle of WNV in different regions of Europe and to isolate the virus (Romania, France, Check republic, USA,...).

The surveillance system has to fit to epidemiological, climatic and geographical conditions in the exposed country (endemic circulation, limited, outbreaks,...)

## Active surveillance based on serological monitoring of sentinel birds in France

In 2004:

- 30 sites in 6 Mediterranean départements
- 300 birds were tested serologically every month from June to October



Jean Hars, ONCFS

# Results of active and passive surveillance in France between 2000 and 2007



Jean Hars, ONCFS

What is crucial for efficient WNV surveillance :

Coordinated effort of public health and animal health actors

Integrated national surveillance system

Trained or at least well-informed physicians, veterinarians and other involved actors

Prepared laboratories with sufficient diagnostic capacities in case of outbreaks

Current situation in Europe :

Diverse national surveillance systems : health-care systems organisations, laboratories and analytical methods

Different reporting systems

## Improvement axes :

Towards a **global surveillance scheme** at the european level?

Harmonization of diagnostic tools

Definition of surveillance protocols (case definition, requirements for confirmation of WNV infection, surveillance methods) in accordance with the peculiarity of WNV epidemiological situation in each country

**European networks** : ECDC (2005), ENIVD (European Network for diagnostics of « Imported » Viral Diseases) or ARBOZONET (Network on zoonotic arboviral infections), aim at strengthening national diagnostic capacities (formation,...), surveillance and response systems in Europe.

**Evaluation of surveillance methods** : impact on disease containment, economic and social impact,...

## Conclusion

### Need for better preparedness :

- rapid disease identification by physicians or veterinarians
- improvement and harmonization of diagnostic tools
- adapted surveillance
- availability of vaccines

### Need for research studies :

- epidemiology in Europe (introduction, virus persistance, vectors, avian amplifying hosts,...)
- risk modeling

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AFSSA Report 2004 : « Rapport sur la surveillance de l'infection à  
virus West Nile en France »

