
## Sturgeons

Sub-family ***Acipenserinae***
genus *Acipenser* (18 sp.)
genus *Huso* (2)

Sub-family ***Scaphirhynchinae***
genre *Pseudoscaphirhynchus* (3)
genre *Scaphirhynchus* (3)


## Farming sturgeons

- Caviar (China, Italy, France, etc.)
- Flesh
- Repopulating: France, Poland, Italy, USA, etc.





**Endangered sturgeon producing high-quality caviar are bred in Florida**

## Farming sturgeons and viruses

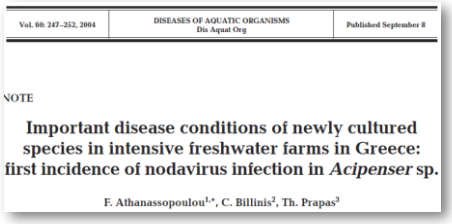
- At least 5 viral families
- Limited biological/epidemiological data
- Dissemination of viruses favored by:
  International trade, legal and illegal

## White sturgeon adenovirus

- Affected juvenile white sturgeon in 1984 (Hedrick 1985)
- 50% mortality over 4 months
- Nuclei enlarged (epithelial cells of intestine)
- Cell cultured on WSS-2 (Hedrick 1991)
- Partially sequenced

- No heard of it since…a while

## Betanodavirus



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NOTE

**Important disease conditions of newly cultured species in intensive freshwater farms in Greece: first incidence of nodavirus infection in *Acipenser* sp.**

F. Athanassopoulou[1,*], C. Billinis[2], Th. Prapas[3]

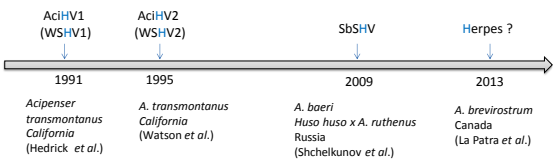
Horizontal transmission, from sea bass to Sturgeon

## IHNV

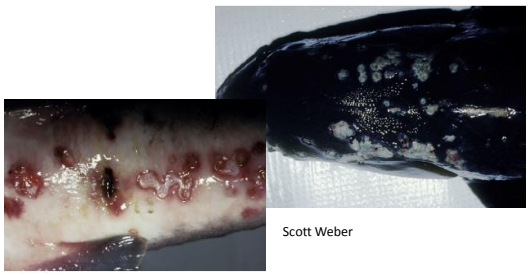
- Experimental infection of white sturgeon (Lapatra et al 1995)

IHNV can replicate in larval white sturgeons but presumably not in juveniles or adults

## *Herpesviridae*

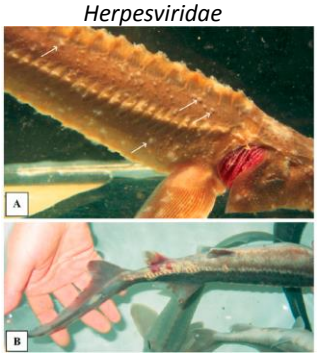



## Herpesviruses are epitheliotropic



Scott Weber

## *Herpesviridae*

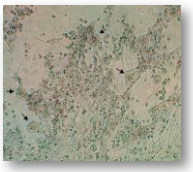



Shchelkunov 2009

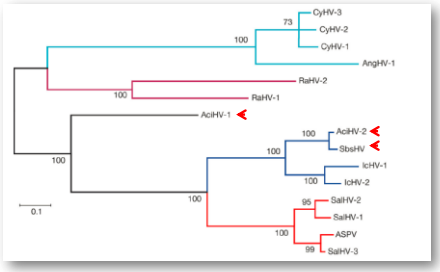
Fig. 4. *Acipenser baeri*. (A) Multiple plaques of epidermal proliferation (arrows) in a fingerling of Siberian sturgeon infected with Siberian sturgeon herpesvirus (SbSHV) and (B) haemorrhagic ulceration of the skin and the lateral scutes of the caudal trunk in virus-infected 2 yr old Siberian sturgeon

## *Herpesviridae*

- Cultivable *in vitro*, on WSSK-1, SSO-2, SSF-2
- cPCR …to improve
- qPCR…to set up



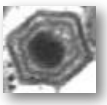
## *Herpesviridae*
## Genetic diversity (DNA pol)



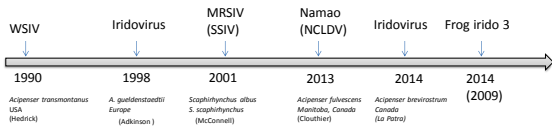

Dozspoly 2013

## *Herpesviridae*
## *To-do list*

- Develop specific diagnostic tests (AciHV1/2)
- Screen farms in Europe (all host species)
- Search for other AciHV species with generic tools

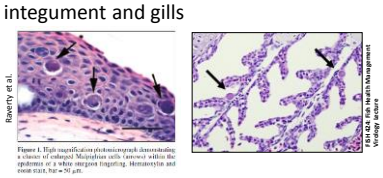


## *Iridoviridae*




## *Iridoviridae* diagnostics

- Histology
  - Basophilic inclusions and enlarged cells in the integument and gills




- WSIV culturable, not the others

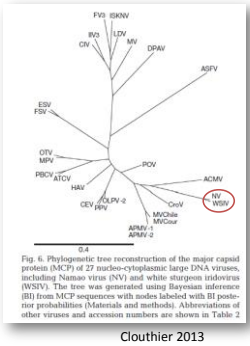
## *Iridoviridae* diagnostics

- PCR → MCP gene
  - cPCR virus-specific or –generic (Clouthier *et al*; Bigarré *et al*.)
  - qPCR virus-specific (Clouthier *et al*; Bigarré *et al*.)

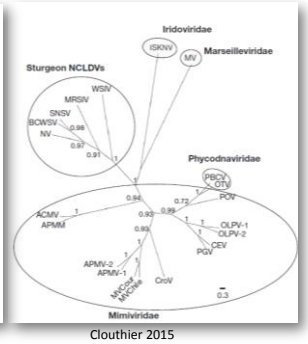
## A complex epidemiological situation

- Various countries ?
  - USA, Canada, Europe
- Hosts
  - Diverse sturgeon species
- A cloud of viruses
  - WSIV, SSIV, MRSIV, SNSV, NV, AciV-E.
  - 1 iridovirus d'amphibien (FIV3)

## *Iridoviridae* ? NCLDV !




Clouthier 2013

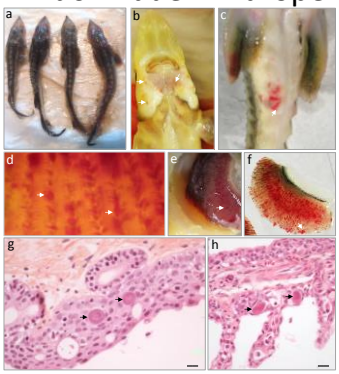



Clouthier 2015

## *Iridoviridae* In Europe

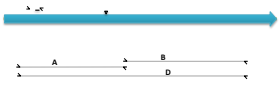
- One (series of) outbreak in 1998, diagnosed by histology. Possibly Belgium and the Netherlands
- These last years, suspicions on Russian sturgeons

## *Iridoviridae* in Europe



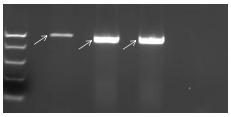

## *Iridoviridae* in Europe
## Development of a generic PCR

MCP gene (1,3kb)




## *Iridoviridae* in Europe
## Testing the method on field samples

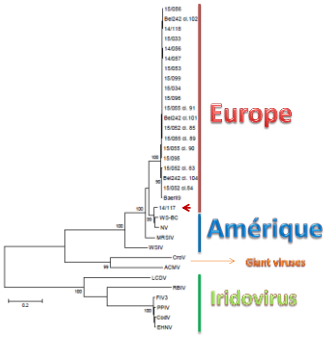
. With or without symptoms
. Polymicrobism



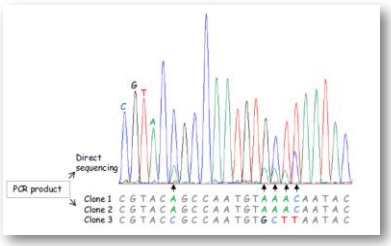
## Positive results

- 4 host species:
  - Siberian, Russian, Beluga, Adriatic
- 3 European countries
- 2 distinct iridoviruses:
  - AciV-E
  - NV

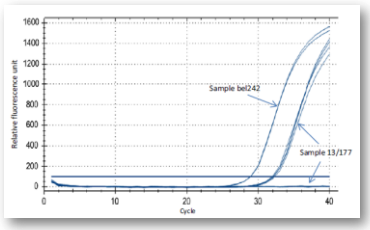
## European samples (MCP gene)




## Intra-sample genetic diversity




## A real-time PCR for AciV-E…
## …nearly validated




## Iridoviridae in Europe conclusions

- At least 2 distinct viruses, probably of American origins
- Detected
  - by a same cPCR
  - by distinct qPCR
- Certainly pathogenic, but virulence is host-dependant…and other factors

## How do viruses spread ?

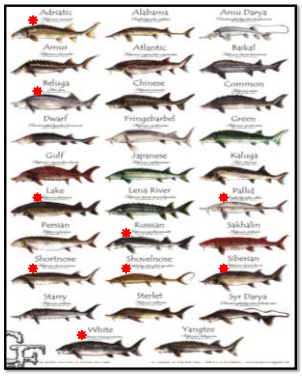
- Infected wild fish used as genitors
- Mix of species in farms
- Hybrids
- International transfers, legal and illegal

## Sturgeon trade (legal)

## Sturgeon trade (illegal)


Fishermen at Giurgeni bridge, Romania, showing that they offer big fish – which often means sturgeons – for sale *© WWF*


## Conclusions




## Conclusions

- Sturgeons viruses are underestimated
- Dissemination without control
- Urgent need for developing PCR-based diagnostic tools
  - To prevent dissemination
  - To shed light on their real virulence
- 'Iridoviridae' are a priority. They are widespread: test your fish !

**Thanks to colleagues**

1 ANSES, Laboratoire de Ploufragan-Plouzané, Université Bretagne-Loire, Plouzané, France
2 Laboratoire des Pyrénées et des Landes, Mont-de-Marsan, France
3 Aquaculture veterinarian, Grisolles, France
4 Groupement de Défense Sanitaire Aquacole Aquitain, Mont-de-Marsan, France
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7 IZSVe, Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro, Italy
8 IZS PLV, Istituto Zooprofilattico Sperimentale del Piemonte, Torino, Italy
9 ONIRIS, AMaROC, LUNAM University, Nantes, France

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**Molecular identification of iridoviruses infecting various sturgeon species in Europe**