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### ► To cite this version:

Jörn Gessner, Marie-Laure Acolas, Eric Rochard, Paolo Bronzi. How common is common? Experiences and results of restoration programs in *Acipenser naccarii*, *A. oxyrinchus* and *A. sturio*. Aquaculture Europe 2022, European Aquaculture Society (EAS), Sep 2022, Rimini, Italy. hal-04940831

**HAL Id: hal-04940831**

**<https://hal.inrae.fr/hal-04940831v1>**

Submitted on 11 Feb 2025

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# How common is common? Experiences and results of restoration programs in *Acipenser naccarii*, *A. oxyrinchus*, and *A. sturio*

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# Sturgeon species of Europe and their population status according to IUCN (2022) and RL 92/43/EWG

 <p>Russian Sturgeon complex</p> <p><b>CR</b>, FFH A-V, CITES A-II</p>	 <p>Adriatic Sturgeon</p> <p><b>CR</b>, FFH A-II, IV, CITES A-II</p>	 <p>Ship Sturgeon</p> <p><b>CR</b>, FFH A-V, CITES A-II</p>	 <p>Atlantic or <b>Baltic Sturgeon</b></p> <p><b>VU/EX</b>, FFH A-V, CITES A-II</p>
 <p>Sterlet</p> <p><b>VU</b>, FFH A-V, CITES A-II</p>	 <p>Stellate Sturgeon</p> <p><b>CR</b>, FFH A-V, CITES A-II</p>	 <p>European/Common Sturgeon</p> <p><b>CR (EXW)</b>, FFH A- II, IV, CITES A-I</p>	 <p>Beluga</p> <p><b>CR</b>, FFH A-V, CITES A-II</p>

# Action Plans for Conservation and Restoration

## 1 *In situ* conservation

- Significant reduction of fishing mortality
- Effective control of allochthonous species

## 2 Protection and restoration of essential sturgeons habitats

- Protecting and improving the quality and continuity of essential riverine and estuarine sturgeon habitats

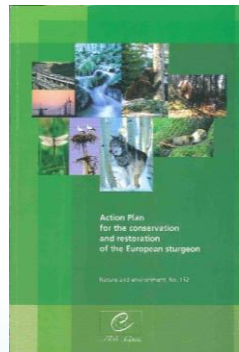
## 3 *Ex situ* conservation and re-introduction

- *Ex situ* conservation
- Release for re-establishment or enhancement

## 4 International cooperation

- Facilitation of international co-operation

### European level



### Regional level



### National level



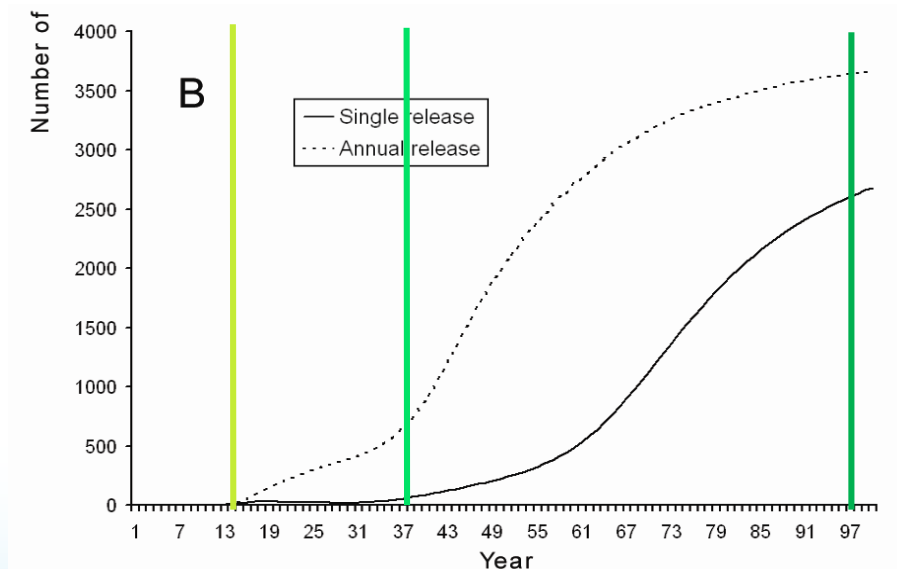
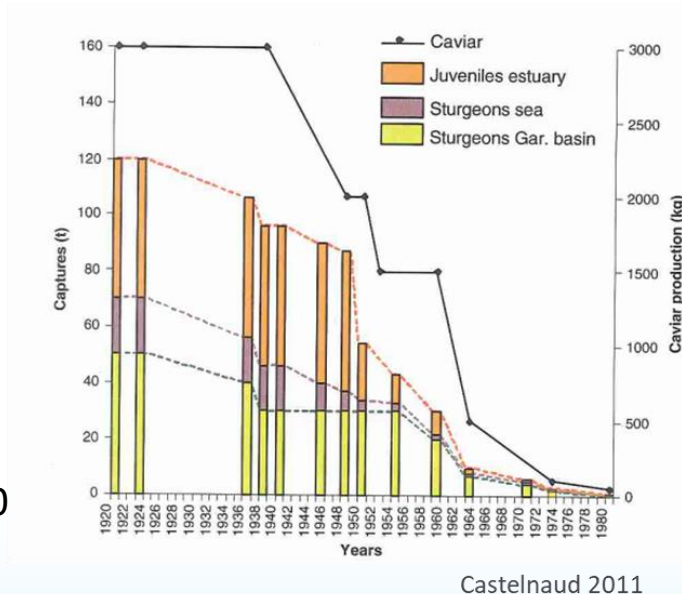
## Actions Plans: Differences in coordination

Criterion	<i>A. naccarii</i>	<i>A. sturio</i> F	<i>A. sturio</i> D	<i>A. oxyrinchus</i> <i>Baltic</i>
Action Plan implementation	3 years plan (2008-2010)	5-10 year plan (continuous)	National plan (not restricted in time)	10 years plan Basin wide and national
Administration	Several initiatives No coordination body for implementation	<b>Coordinated by a joint committee including stakeholders</b>	No coordination body for implementation	Coordinated by a scientific body on Helcom level (EG STUR)
Supervision	None	<b>Supervision by Environmental Ministry</b>	Cooperation with Environmental Ministry	Cooperation with Environmental Ministries

# Why chose stocking to restore populations ?

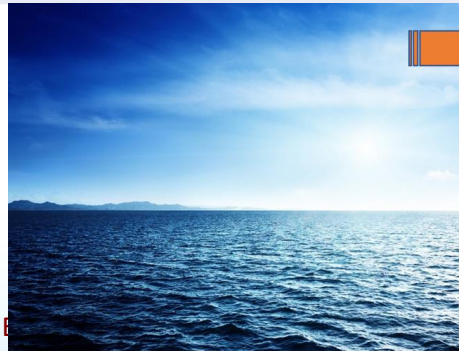
- **Protection measures too late** after the onset of decline
  - Habitat protection insufficient or too late
  - Protection in fisheries ineffective, bycatch continued to remove last individuals
- **Reproduction at low population sizes too rare** (extinction vortex) and mortality of early life stages too high (Boreman 1997)
- Without releases the **recovery time** at least twice as long, thus **increasing the risk of fatal effects of adverse impact** (>25 years considering population growth curve (Jaric & Gessner 2014))

Catches of *A. sturio* in the Gironde from 1920 to 1980



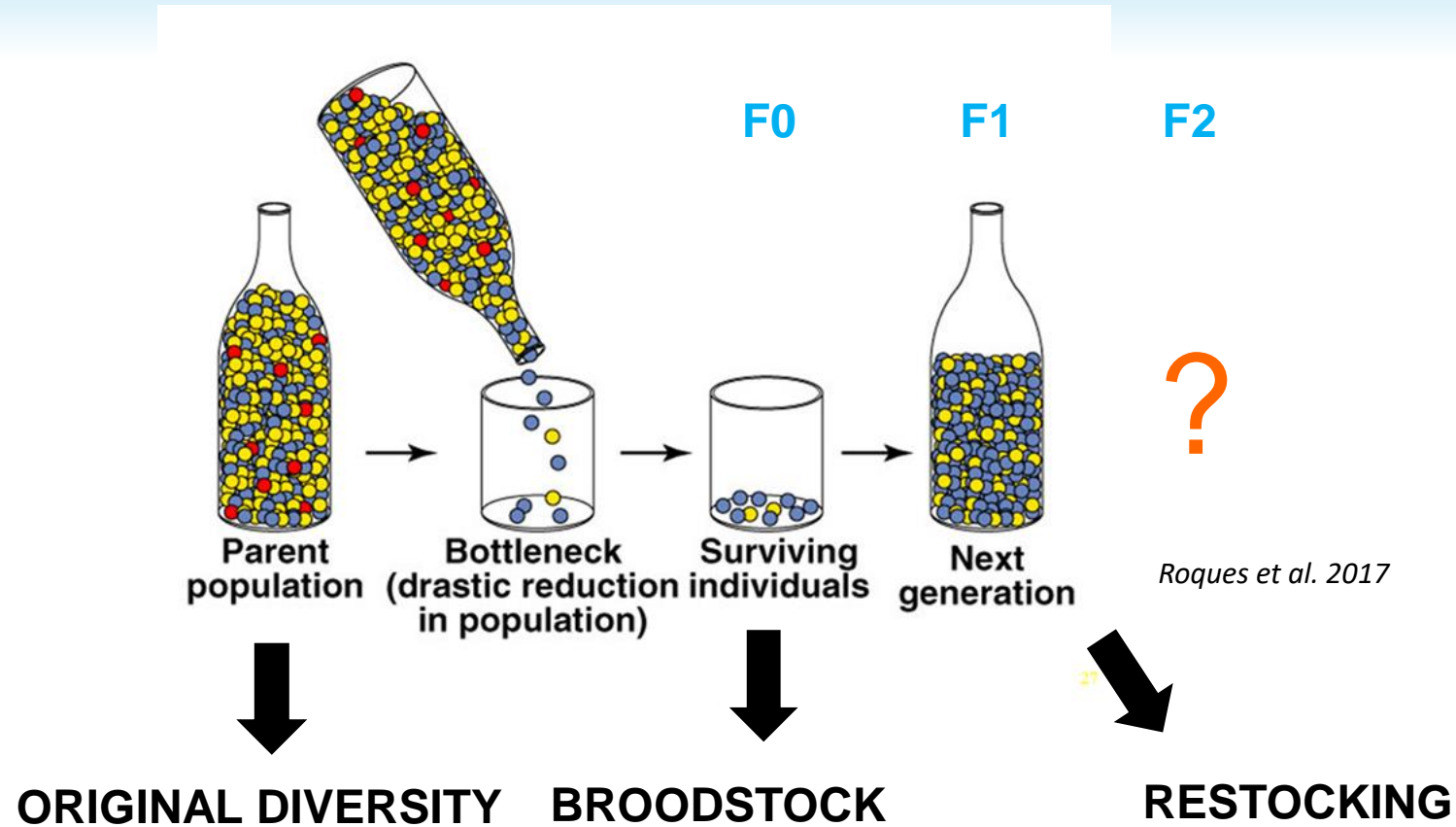
# Ex situ conservation: broodstock development

	<i>A. naccarii</i>	<i>A. sturio</i> F	<i>A. sturio</i> D	<i>A. oxyrinchus</i>
Last observation of reproduction	Unknown (1970s?)	1994	1964	Pre 1960
Population size at onset of restoration efforts	Unknown (50-100??)	500-2000 (Rochard, 1992)	0	0
<b>Onset of <i>ex situ</i> measures</b>	<b>1977</b>	<b>1994</b>	<b>1996</b>	<b>2004</b>
Collection of spawners in the wild	Juveniles animals captured in the wild (PO, Adige, Adda, Oglio) in the seventies	Wild spawners collected at sea and in the Gironde system	Only at population levels pre 1900 Backup population from F1	Not effective after 1900 <b>Mature fish imported from Canadian population</b>



# How was stocking implemented ?

## *Ex-situ conservation: broodstock development*



### Countermeasures:

- **Start early** with collection of broodstock from the wild - don't miss the chance.
- **But when to start** to limit impact on the wild population?
- Include **wild fish** whenever possible to enhance genetic diversity
- Implement **genetic breeding plans** to minimize inbreeding and outbreeding
  - Reproduction strategy based on families (Boscari et al. 2016)
  - Studbook implementation (Roques 2018)



# First results of the recovery programs

## *Ex-situ stock composition*

Criterion	<i>A. naccarii</i>	<i>A. sturio</i> F	<i>A. sturio</i> D	<i>A. oxyrinchus</i>
2022 <i>ex situ</i> stock size	474 F1 (balanced sex ratio, 30 familiar group)	146 Ind. (N♀, N♂)	398 Ind. (194♀, 204♂)	860 (410♀, 450♂)
2022 Number of potential spawners	About 50 ♀, and about 100♂	5♀, 15♂	0♀, 12♂	12♀, 26♂
Assisted reproduction from <b>F1</b>	About 10,000 larvae in 2021	About 800 larvae obtained in 2022	none	> 400 000 larvae from 3 females since 2018

# How is stocking implemented ?

## *Ex situ conservation: broodstock development*



- Save the species from extinction
- Safeguard remaining genetic heterogeneity
- Increase the number of individuals for stocking
- Increase knowledge about the species
- Citizen education



- Impact on the original population by taking specimen
- Adaptation to captivity conditions: genetic and behavior losses
- Difficulty in reproduction
- Constraint to manage the broodstock (perennial funding, qualified staff)
- Requires genetic broodstock management

**➔ Secure reproduction (best conditions, best food) and maintain diversity**

# First results of the recovery programs

## *Monitoring in the wild to assess stocking results*

Criterion	<i>A. naccarii</i>	<i>A. sturio</i> F	<i>A. sturio</i> D	<i>A. oxyrinchus</i>
Monitoring	Through telemetry and accidental bycatch	<b>6 sampling/year in the Gironde Estuary</b> Bycatch reports Telemetry	Only through telemetry and accidental bycatch	Only through telemetry and accidental bycatch

## First results of the recovery programs

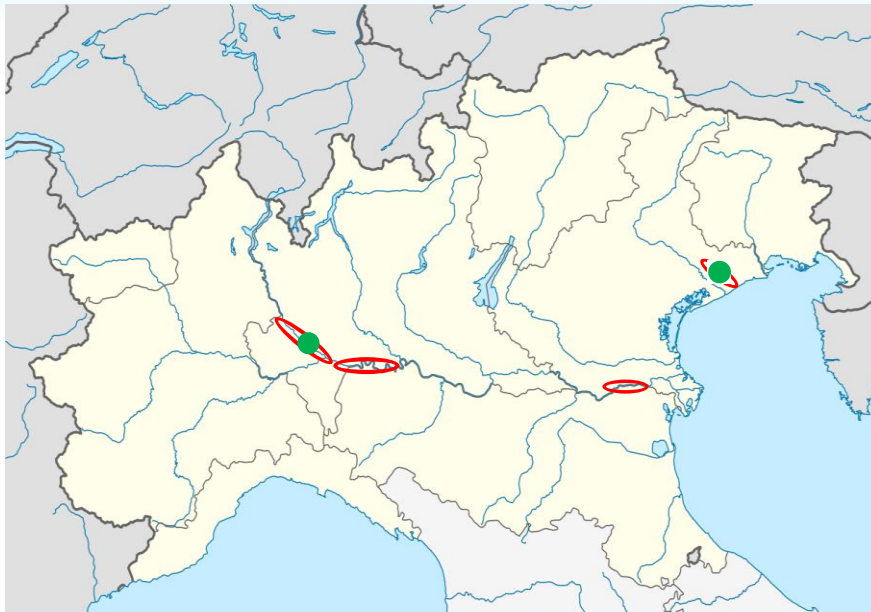
### *Juveniles stocked and adult observation in the wild*

Criterion	<i>A. naccarii</i>	<i>A. sturio</i> F	<i>A. sturio</i> D	<i>A. oxyrinchus</i>
Stocking period	1989-2018	1995 and 2007-2015	2008-2015	2006-ongoing
Fish released	Abt. 600.000	Abt. 1.700.000	Abt. 19.600	Abt. 4.600.000
Returning adults (observed)	More than 20 in recent years	8 observations of adults in freshwater since 2020	8 adults in freshwater since 2020	1 adult in freshwater in 2017
<b>Reproduction in the wild</b>	<b>Probable yes</b>	<b>No</b>	<b>No</b>	<b>No</b>
<b>Natural recruitment</b>	<b>Fingerlings observed</b>	<b>No</b>	<b>No</b>	<b>No</b>

# First results of the recovery programs

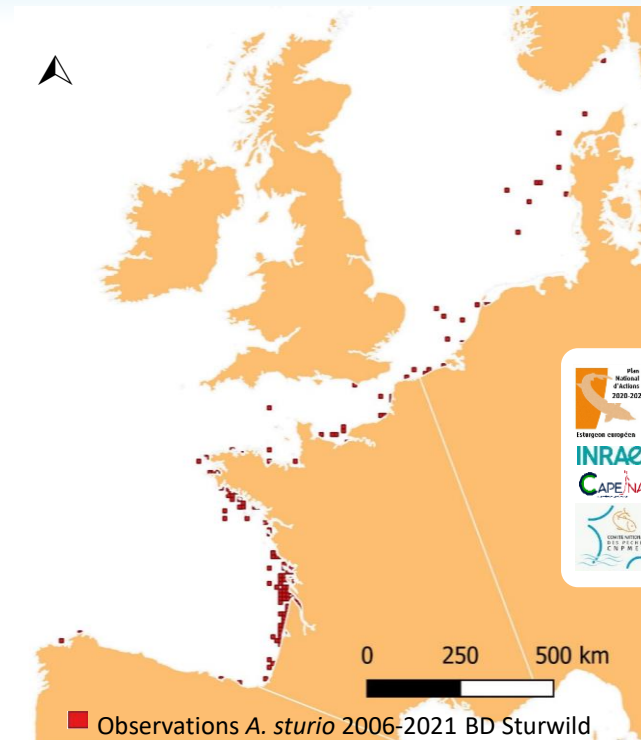
## Monitoring in the wild: incidental observations

*A. naccarii* incidental observations  
2003-2015



Congiu et al, 2021

*A. sturio* incidental observations  
2006-2021

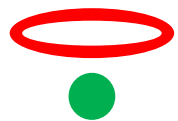


Charbonnel & Acolas 2022

*A. oxyrinchus* incidental observations  
2010-2017



Habitat at sea  
Size & location (sea, estuary, river)



Big animals (bycatch)  
Fingerlings (nat. Rep.)

## ***Lessons learned - practical***

- **In the absence of reproductive population, recovery of populations need active support to**
  - Limit impacts upon essential habitats (spawning, early life phases)
  - Limit mortality linked to fisheries & navigation
  - Enhance awareness
  - Acquire knowledge to improve information on potential critical impacts
- It is important to start with ***ex situ* measures before the species becomes rare** to preserve sufficient genetic heterogeneity
- **Implement conservation aquaculture** practice, not only aquaculture

## ***Lessons learned - administrative***

- Recovery requires **coordination with sufficient authority**
- **Challenges** in habitat protection and restoration requires a **multitude of stakeholders to be involved**
- **Clear prioritization** of recovery over other uses necessary
- **Funding** must be institutional and must be provided in accordance with Action Plan targets to avoid friction in implementation
- **International collaboration** can help to
  - Overcome national obstacles
  - Share methods and knowledge
  - Increase survival at sea
  - **Coordination of the measures important** / sharing methods and knowledge

## ***Lessons learned – issues to be solved***

- Future challenges comprise:
  - **Conflict between supported and self-sustaining populations**
    - **when to stop releasing ?**
    - **when to stop *ex situ* stocks ?**
  - Long-term **maintenance of broodstock** (size adapted to needs)
  - **Cost split** between national and collaborating beneficiaries
  - **Ensuring long-term monitoring** of performance of fish after release, during and after natural reproduction to determine impacts and countermeasures
  - Responsibility for and **extent of rehabilitation measures**
  - Addressing the challenges of **climate change**



# Cordial thanks to all contributors & Thank you for your kind attention!

