Aquaculture and conservation breeding - Conflict or concurrence?

The Danube sturgeon example

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dstf
Danube Sturgeon Task Force

in cooperation with

IAD

World Sturgeon Conservation Society e.V.
W.S.C.S.
established 2003

dstf
Danube Sturgeon Task Force

Founded in 2012 under the frame of the EUSDR.

- Main aim: Implementation of the Danube Sturgeon Action Plan from 2006 (SAP)
- Regrouping 76 actions (SAP) into six main topics of “Sturgeon 2020“

www.dstf.eu

network – platform – interface

“Sturgeon 2020“ conservation strategy

Why Sturgeon conservation in the Danube River Basin?

- Unique value for EU biodiversity - the only river basin still sheltering 5 sturgeon species.
- High scientific value - “living fossils”, over 200 million years old.
- Excellent indicators of habitat quality and connectivity.
- Flagship species: ecologic, economic and social heritage of DRB.
- Sturgeon Conservation explicitly mentioned as target in Pillar II of EUSDR.

“Sturgeon 2020“

- **In-situ and ex-situ topics and measures directly target the sturgeons.**
- **In-situ – meaning: on site (river) and ex-situ – meaning: off site (captivity).**
- **Ex-situ measures comprise aquaculture methodologies, like hatchery operation and controlled propagation.**

In-situ and ex-situ - linkage

- **In-situ delivers the overall concept for ex-situ.**
- **Ex-situ delivers (positive) effects for in-situ.**
- **In-situ delivers orientation and feedback for the adjustment of ex-situ.**

Basic facts on sturgeon aquaculture

- Sturgeon aquaculture has started with sterlet in the 1870‘s in Russia
- Aquaculture currently produces more sturgeon meat and caviar than is harvested from fisheries
- But aquaculture of sturgeons is still in its infancies
  - Increasing numbers of diseases are observed
  - No domesticated or selected strains are available yet
  - Rearing for production and for release do not constitute different methodologies yet
- Aquaculture largely contributes to the introduction of exotic sturgeons worldwide

Conflict or concurrence? - Examples

- **A Sturgeon Ranching Programme (SRP) in the former U.S.S.R. was initiated in 1950.** Millions of sturgeon fingerlings were released but **populations could not be stabilized**. Since the late 1980s fewer hatcheries were operated, due to a lack of funds and broodstock (catches in the rivers also proved difficult because the spawners were becoming scarce). Because of economic and political changes as well as a decrease in funding, the controlled propagation of sturgeons and stocking in the former U.S.S.R. faces a crisis today. This, in combination with a lack of natural reproduction, increased harvesting and poaching, **lead to a severe decrease of sturgeon stocks in the Caspian Sea** (Artyukhin et al. 1999, Khodorevskaya 1999, Secor et al. 2000).

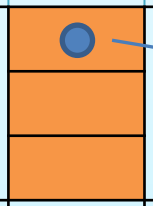
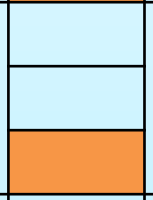
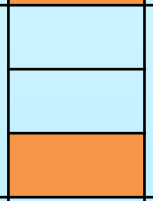
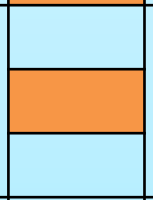
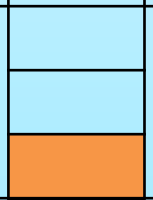
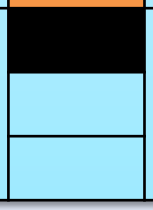
- **In the early 1990s a functional ex-situ broodstock of the European Atlantic sturgeon *Acipenser sturio* was initiated** in France as the only means of saving the species from extinction. A systematic approach for controlled propagation began in May 2007 using 79 fish of wild and hatchery origin (Beamesderfer & Farr 1997, Williot et al. 2009). **Without these measures this species would have been lost** due to a lack in natural reproduction.

Rationale

- Declining populations reveal increased impact of Allee Effect, increasing extinction risk
- Extirpation (in sturgeons) occurs over a period of 50+ years with underlying reasons mostly not fully understood
- Ex-situ rearing is the only means to prevent extinction if adverse impacts are not reversed in due time (at sufficient population levels)
- Timely securing of the genetic resource requires sufficient numbers of individuals

What is a sturgeon?

Danube Sturgeon species

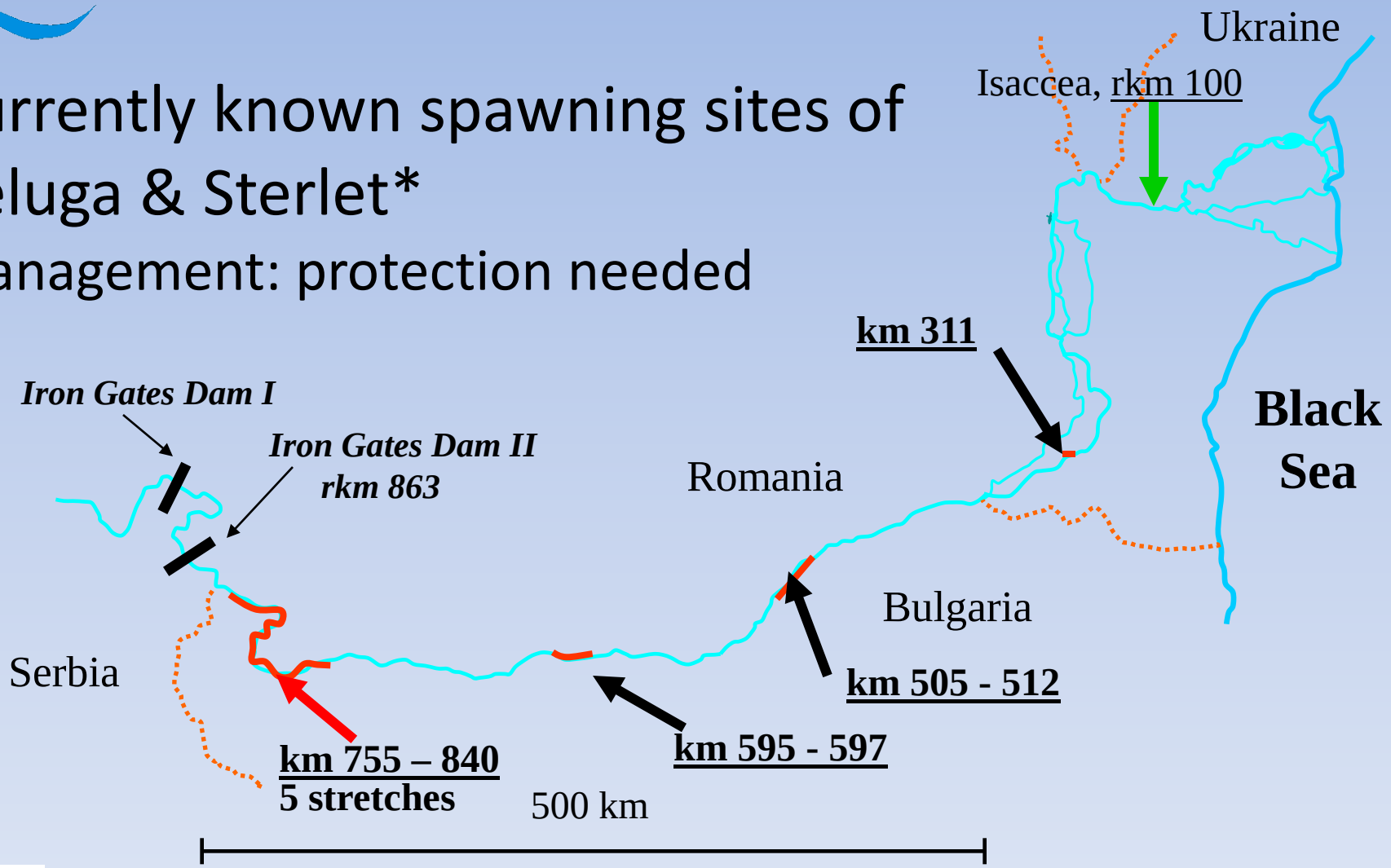
Species	IUCN 2010	Basin	Remarks
A. ruthenus	Vulnerable **Declining** in MD		• Jochenstein • controlled propagation • Programs for UD & MD linked to in-situ measures/ population status
A. gueldenstaedti	Critically endangered		• only individuals in annual catches • controlled propagation • spring and fall migrants • immediate rescue programme
A. stellatus	Critically endangered		• controlled propagation • evidence for substructured population • spring and fall migrants • ex-situ measures as backup option
A. nudiventris	Critically endangered **Nearly exctinct** in DRB		• no controlled propagation • extremely rare • immediate rescue programme
H. huso	Critically endangered		• spring and fall migrants • potential substructuring of population • ex-situ measures for safeguarding
A. sturio	Critically endangered **Extinct** in DRB		No detailed information available and former distribution discussed controversially.

Sturgeon traits	Implications for ex-situ conservation
adapted – are able to adapt	• specific to river • susceptible to hatchery selection, inbreeding and outbreeding
form different stocks and forms	• a population analysis is essential for the formation of broodstock or founder populations - natal homing
popular - endangered - rare - hybridize	• high in demand – availability? • special attention and husbandry conditions • exotic genes pose a potential threat to natural populations.
old – late – large **not annually – complex - first year**	• recovery takes decades – needs long-term commitment • long time to establish broodstock from juveniles • need special attention and husbandry conditions • past deficits in reproduction will cause future deficits through the drop-out of year classes of spawners • juveniles have to be adapted to high survival rates and not to hatchery conditions
migrate	• sturgeons cross borders, which complicates a coordinated conservation approach for both in- and ex-situ measures

Monitoring

Currently known spawning sites of Beluga & Sterlet*

Management: protection needed



* **Kynard, Suciu & Horgan (2002); Vassilev (2003)**

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River and Habitat Continuity Interruption - Current Situation (2009)

MAP 5

www.icpdr.org

This ICPDR product is based on national information provided by the Contracting Parties to the ICPDR (AT, BA, BG, CZ, DE, HR, HU, MD, RO, RS, SI, SK, UA) and CH, except for the following: EuroGlobalMap v2.1 from EuroGeographics was used for national borders of AT, CZ, DE, HR, HU, MD, RO, SI, SK and UA; ESRI data was used for national borders of AL, ME, MK; Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as topographic layer; data from the European Commission (Joint Research Center) was used for the outer border of the DRBD of AL, IT, ME and PL.

icpdr iksd
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

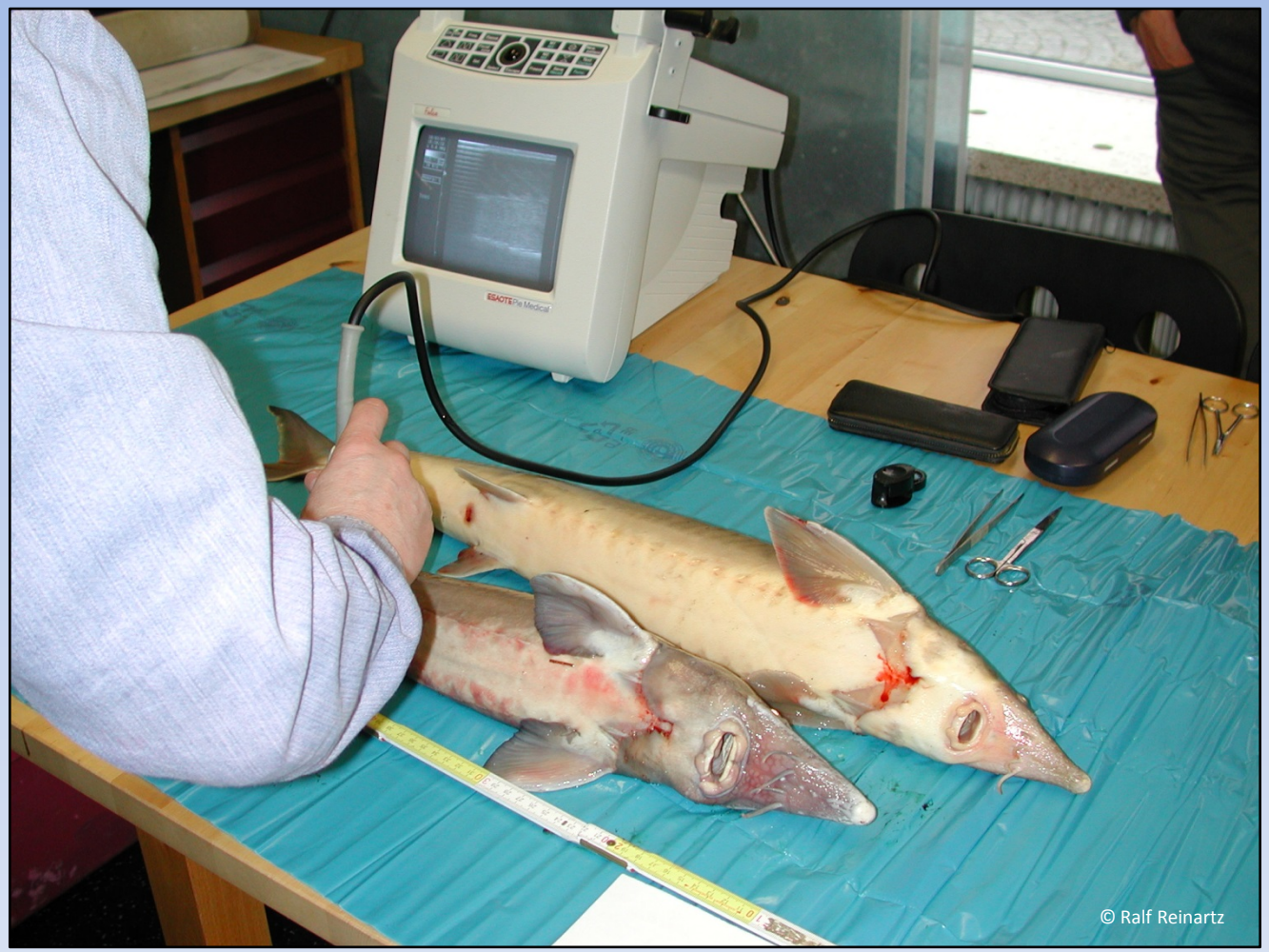
Vienna, December 2009

Apatin, Serbia 2003

Murakeresztur, Hungary 2005

Mohacs, Hungary 2009

Siberian sturgeon and native sterlet from Aschach impoundment



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Small male sturgeon to be released after propagation

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Strategic demands for ex-situ measures as included in Sturgeon 2020

- **Long-term** commitment (not years but decades) (Jaric 2009)
- **Establish** non-commercial live gene banks (ecological “hatcheries”) with governmental support (near-natural enclosures, located in the proximity of re-stocking sites, to allow wild broodstock to adapt to captive conditions and captive bred offspring to adapt to natural conditions before reintroduction in the river)
- Creation of a **regional network with open access** for all participating countries (more shoulders to carry the “burden“, spread of risks)
- **State-operated and controlled** (as public entity), shared resource for nature conservation (with participation of the private sector)
- **Captive** populations **have to resemble wild** ones
- Propagation procedures have to deliver offspring with **increased fitness in the natural environment**/ no selection to hatchery conditions

Basic requirements for an ex-situ breeding programme

- Founder populations resembling the wild ones.
- Facilities mimicking the natural habitat as closely as possible.
- A data compilation (studbook) to maintain and manage genetic diversity, integrity and demographic stability.
- A coordinator.
- Specific protocols and procedures for e.g. breeding techniques, husbandry and transport.

Future demands for sturgeon aquaculture

Distinguish between sturgeons for ex-situ conservation and for farming (broodstock and offspring)

Ex-situ conservation

- Developing criteria for production of stocking material
- Rearing juveniles with fitness for survival in nature!
- Avoiding domestication effects
- Develop genetically suitable breeding plans preventing inbreeding & outbreeding depression!
- Ensure homing
- Adaptation to adverse impacts (diseases, predators)

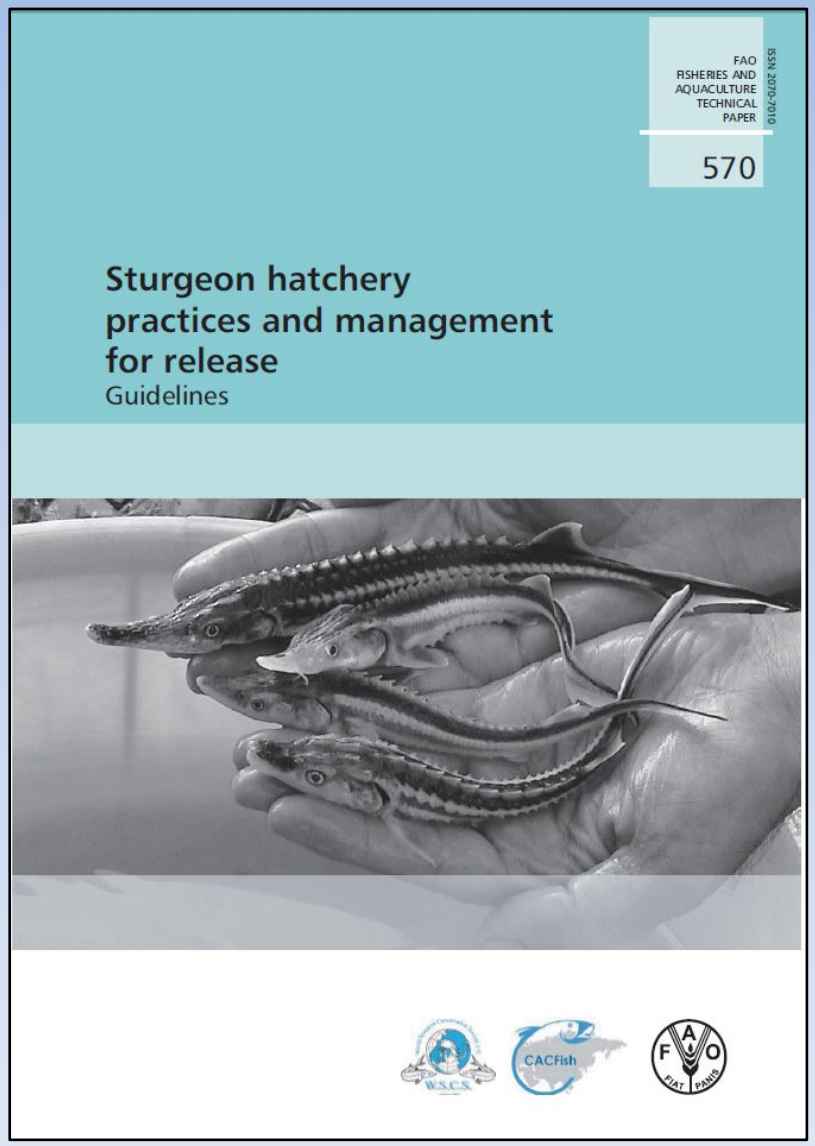
Farming

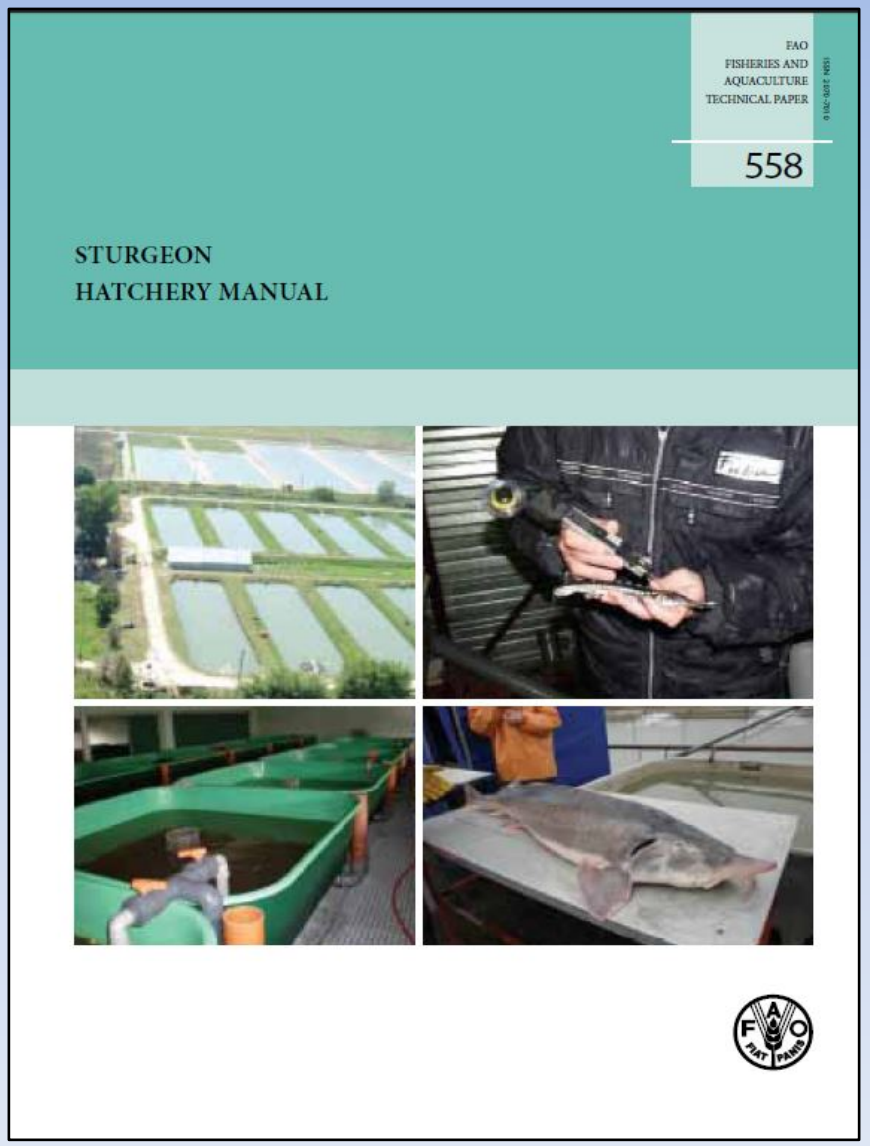
- Domestication and selection for aquaculture
- Improvement of rearing conditions
- Increased prevention to avoid interference of both groups (escapement, disease transfer, genetic interference)

Conflict or concurrence?

- aquaculture is an indispensible and powerful tool for ex-situ conservation measures
- has to be used wisely and goal-oriented
- has to be based on (applied) science
- aquaculture for conservation purposes is not an end in itself
- aim of ex-situ measures is to help sturgeons to survive in the river

for further reading





Danube giants in our hands