Future of Danube sturgeons: International station for Danube sturgeon's conservation and migratory fish research (Conceptual Note)

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Abstract. Sturgeons are some of the most endangered species in the world - reflected by the critical indicative (CR) in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species™ and the adoption of a new Action Plan for sturgeons on EU level in 2018. The Black Sea and its catchment rivers still have reproductive populations of four native migratory sturgeon species, which is unique worldwide (*Huso huso*, *Acipenser gueldenstaedtii*, *A. stellatus*, *A. sturio*, *A. ruthenus*, *A. nudiventris*) and was declared as flagship species; these living fossils represent a unique component of the biodiversity. They represent not only a natural heritage of the Danube River Basin, but also a key indicator species for the ecological quality of rivers (ICPDR 2018). Sturgeon species recovery is of maximum importance worldwide. Populations of migratory sturgeons use a variety of riverine and marine habitat types at different developmental stages to complete their life-cycle, they also cover long distances regardless of national borders. This also applies to the Black Sea Basin, were sturgeons once inhabited the sea itself and all major rivers, serving as spawning habitat. Therefore, measures and recommendations were taken and developed at international and EU level. Apart from urgently needed ex-situ conservation measures to secure populations on the brink of extinction, a science-based population-habitat monitoring and resulting management have uniformly been identified as the most important conducive measure for the successful recovery and conservation of sturgeon populations. For the range countries of the Danube and the Black Sea, the establishment of a biodiversity conservation unit for the native sturgeon species (aka as sturgeon conservation hatchery) is urgently needed. The ideal opportunity and geographic position empowers and honours Romania to be the host of this sturgeon conservation unit that will combine the scientific and ecological needs and potential of the riparian countries of the Black Sea and the Danube with regard to the protection, conservation, recovery, monitoring and research of sturgeons under its aegis.

Key Words: most endangered species, critical indicative, threatened species, action plan, living fossils.

Introduction. The order of Acipenseriformes is represented by 27 species (Annexe 1) occurring throughout the whole Northern Hemisphere (Bemis & Kynard 1997; Ionescu 2020).

The special importance of the Danube in this context is given by the fact that it represented the habitat for 6 of these species of sturgeon (Bacalbasa 1997), and being among the last natural water habitats, where these species can be found and reproduce in the wild. Two species, the Sterlet (*Acipenser ruthenus*) and the Ship sturgeon (*A. nudiventris*) are freshwater species respectively forms, they live and reproduce in the Danube. Four anadromous species, the Beluga sturgeon (*Huso huso*), the Russian sturgeon (*Acipenser gueldenstaedtii*), the Starry sturgeon (*A. stellatus*) and the European sturgeon (*A. sturio*), which reproduce in the Danube and live in the Black Sea (Figure 1). All these species are critically endangered or extinct in the Black Sea Basin. They are also species of common interest, being a priority at international level and with protection measures and recommendations having been adopted both at international and EU levels.

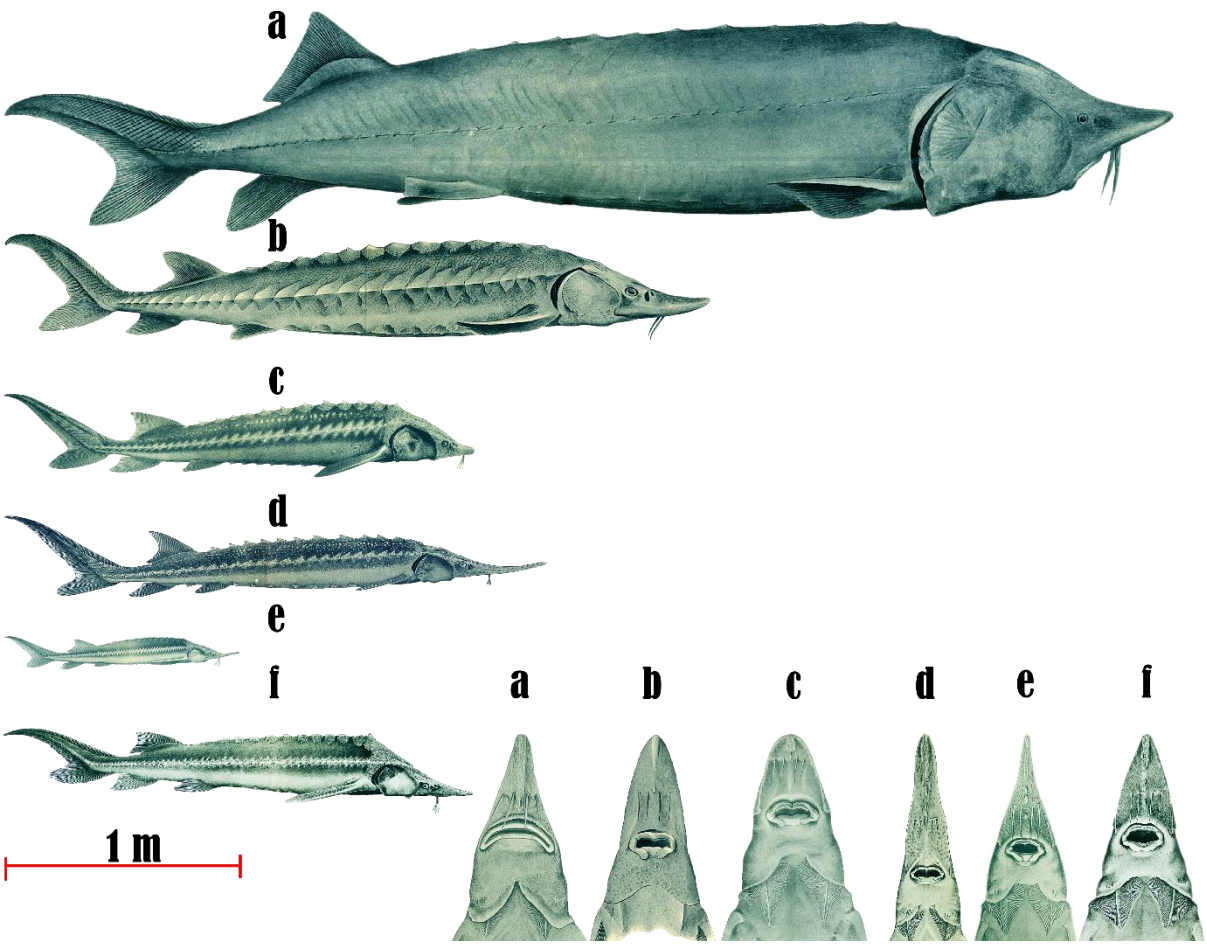

Figure 1. The Danube sturgeon species at scale according to the maximum lengths, for each species, described by (Chebanov 2013). At the bottom, the details of the ventral part for each species. a) Beluga sturgeon (*Huso huso*) – 500 cm; b) European sturgeon (*Acipenser sturio*) – 300+ cm; c) Danube (Russian) sturgeon (*Acipenser gueldenstaedtii*)- 200 cm; d) Stellate (Starry) sturgeon (*Acipenser stellatus*) - 220 cm; e) Sterlet (*Acipenser ruthenus*) -100 cm; f) Ship (Spiny) sturgeon (*Acipenser nudiventris*) - 200+ cm - personal adaptation after Antipa (1909).

These "living fossils" in the Black Sea basin, declared as ”Danube Sturgeons – the flagship species of the Danube River Basin” (ICPDR 2016), represent a unique component for the biodiversity of the aquatic ecosystem in this area, and their importance, both from scientific and a socio-economic perspective, is indisputable at international level.

The sturgeon species are classified in the IUCN Red List as being critically endangered (IUCN 2009), and are also included in the following international regulations and in the report of some official meetings: Galati Declaration on Sturgeon Conservation in the Danube Basin, the Danube Delta and the Black Sea (GSC19 2019); The Pan-European Action Plan for Sturgeons (WSCS & WWF 2018); The ICPDR Sturgeon Strategy (ICPDR 2018); Vienna declaration on global sturgeon ISS8 (WSCS 2018); The International High-Level Conference for the Protection of Sturgeons (ICPDR 2018); Annex 5 of the EC Directive for Habitats (Directive (EU), 1992); Annex 2 of the Convention on International Trade with Endangered Species of Wild Fauna and Flora (CITES 1973); Ramsar Declaration on Global Sturgeon Conservation (Ramsar Declaration on Global Sturgeon Conservation, 2005); Action plan for the conservation of sturgeons in the Danube basin approved by the Berne Convention in 2005 (Bloesch et al 2006); Appendix II - Convention on the Conservation of Migratory Species of Wild Animals (CMS 2018); Convention on Biological Diversity (CBD 1992); RAMSAR Convention (RAMSAR 1975); Black Sea Convention on the Protection of the Black Sea against pollution (BSC 2009).

General framework. In the current environmental context, the need for conservation and fundamental research of sturgeon species and their habitats is an international priority. Ex-situ conservation to support populations is indispensable for ensuring sustainable biodiversity of wild sturgeon population, as currently they are in a dramatic decline in the world and also in Romania (Figure 2).

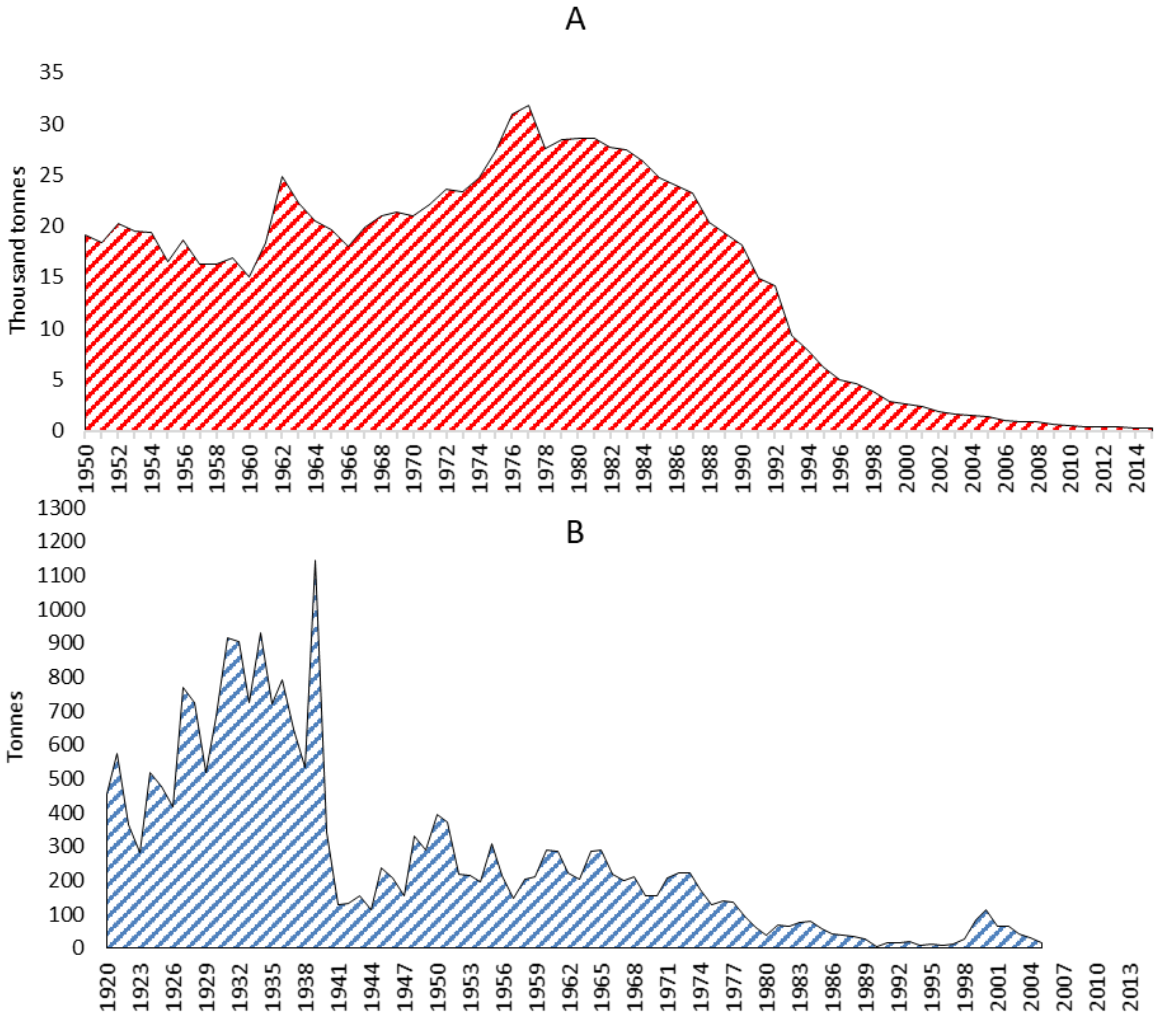

Figure 2. Commercial catches of sturgeon. A) Worldwide; B) Romania.

It is also necessary to discover/analyze the causes that directly and indirectly affected aquatic habitats and wild sturgeon populations, as well as to research/understand the sturgeon life-cycle including specific behavior at all development stages, to identify the conditions indispensable for developing optimal solutions for the recovery of sturgeon populations in the Black Sea Basin, on short, in the future, to can treat causes rather than effects.

One of the most important priority measures for the conservation and recovery of the Danube Sturgeon is to establish a "live gene bank", a special ex-situ facility to secure the genetic diversity of sturgeon populations. The establishment of an ex-situ facility for sturgeon conservation is also one of the objectives of the Pan-European Action Plan for Sturgeons. - Objective 2 ″population structure is actively supported to reverse the decline" and the objective 5 "timely and continuous detection of population sizes and changes in remaining wild stocks".

A dedicated facility for sturgeon must be developed, for all these aspects, with all the elements necessary for conservation of sturgeon species and research and monitoring

the migratory fish from the Danube and Black Sea (Reinartz et al 2003; Sandu et al 2013). For this purpose, the establishment of an International Station for Danube Sturgeons Conservation and Migratory Fish Research in the Northwest Black Sea, between Sf. Gheorghe and Sulina Arm, would be a unique opportunity at both national and European levels; this is due to the ideal position from both the geographical and functional points of view.

The whole potential of such a station with its unique geographic position, granting access to the Black Sea, the Delta and the Danube and their wide variety of marine, estuarine and riverine habitat, will make it a best facility for in-situ research and monitoring and ex-situ conservation. Through regional and international scientific collaboration for study of migratory fish and aquatic habitats will make it a top unit on a worldwide scale (Reinartz 2002; Bloesch et al 2006; ICPDR 2018).

The facility will be organized in two distinct directions, however closely related, and interconnected by the specific nature of its main objective, the recovery of wild sturgeon populations (Sandu et al 2013):

1. The first direction will be the ex-situ conservation of the sturgeon biodiversity, by creating a "live gene bank", with all critical endangered sturgeon species from Black Sea and Danube (*H. huso*, *A. stellatus* and *A. ruthenus*), or for species that are extinct or on the brink of (*A. sturio*, *A. nudiventris*, *A. gueldenstaedtii*). In this case species must be reintroduced from other areas, forming a broodstock of high genetic diversity in time (Williot et al 2009). The uniqueness of this "bank" will be the completely new approach to the ex-situ conservation concept, in that the conservation unit will include facilities adapted to each life cycle, specific to the respective sturgeon species, and at the same time respecting the parameters of the natural aquatic habitat.

Depending on the situation in the wild of each species, identified by rigorous studies, will be initiatives of stoking activities with sturgeon fingerlings obtained by controlled propagation in a specialized facility (conservation unit). Conditions as close as possible to the natural environment (the preferred habitats) will be created so that adaptability to the wildlife of these juveniles is natural and their propagation will follow all the genetic principles to ensure a high genetic diversity. The design of the facility will, in time, ensure the support of the conservation of broodstock with different genotypes and ages, so that the specimens will resemble the wild ones in every important aspect.

2. The second direction will be Research and Monitoring, including studies of fundamental interest on the factors that affected and are still affecting wild sturgeon populations and their life-cycle, as well as the in-situ behavior of wild sturgeons, in the context of current ecosystem research, at all developmental stages. These studies have the purpose of filling deficits in knowledge concerning the synergic action of the factors responsible for the increasing decline of sturgeons. This will generate the correct solutions of in-situ protection for these species and the continuous monitoring of migratory fish.

Through this concept, this facility differs from a commercial aquaculture focused on caviar/fish production for customers through different purposes, concept, methodology and product, and with the destination and criteria for selecting the biological material being different as they are presented in Figure 3 (Reinartz et al 2016).

The interconnectivity and complementarity of the two directions of the International Station for Danube Sturgeons Conservation and Migratory Fish Research, makes this facility a complete unit that will have all the necessary conditions to approach in-situ and ex-situ fundamental research and monitoring, incorporate international novelties and to look at the ideal technical, scientific and practical conditions for the establishment of a 'live gene bank", unique even at an international level.

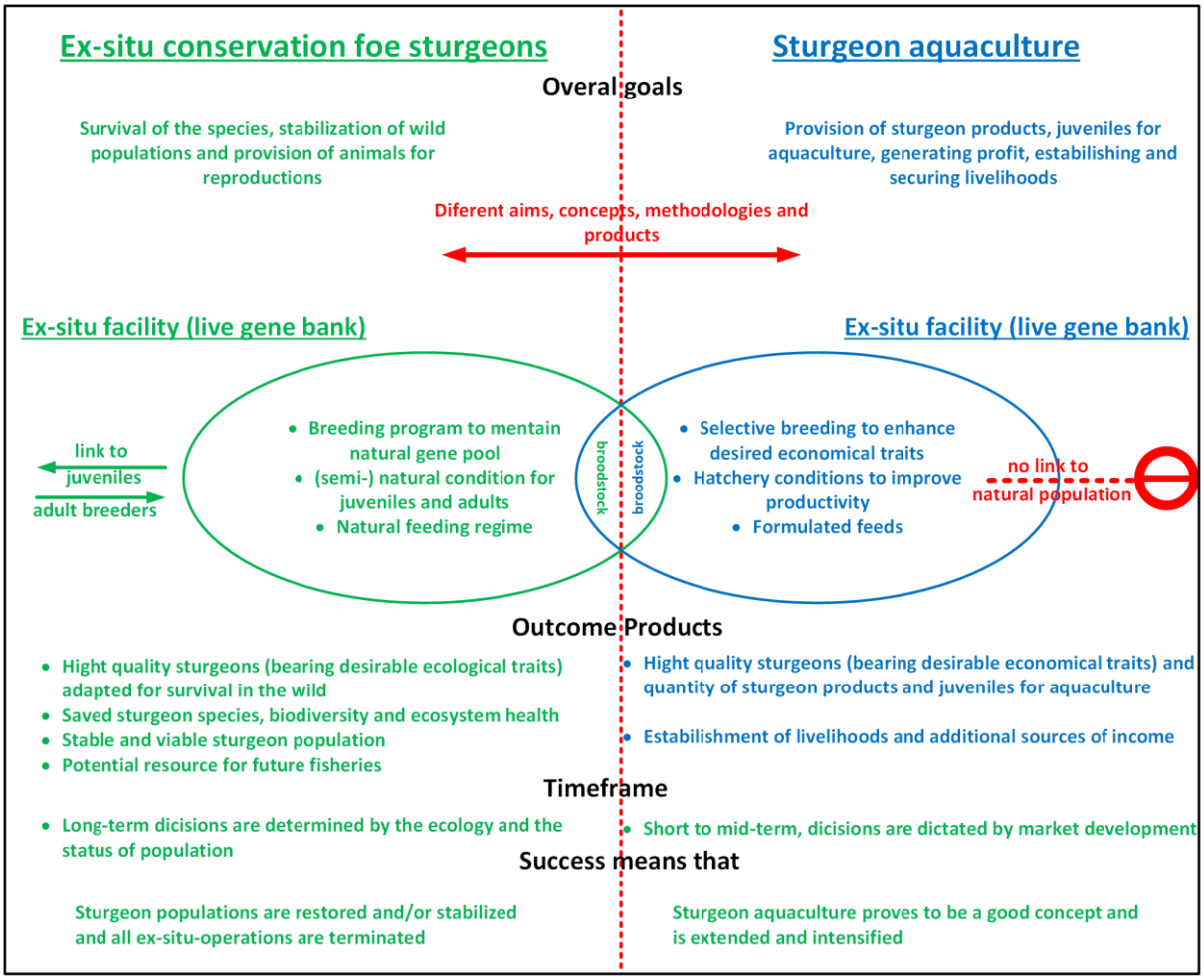

Figure 3. Main differences between Ex-situ facility for sturgeons and sturgeon aquaculture (Reinartz et al 2016).

Facility concept

A. Ex-situ conservation facility

For the riparian countries of the Danube and the Black Sea, the establishment of a biodiversity conservation unit for the native sturgeon species (as sturgeon conservation hatchery) is urgently needed (Bloesch et al 2006; ICPDR 2018; WSCS 2018). The ideal opportunity and geographic position empowers and honors Romania to be the host of this sturgeon conservation unit that will combine the scientific and ecological needs and potential of the riparian countries of the Black Sea and the Danube with regard to the protection, conservation, recovery, monitoring and research of sturgeons under its aegis.

The ex-situ facility (Conservation Unit) of the "International Station for Danube Sturgeons Conservation and Migratory Fish Research (ISRCDS)", will be a facility dedicated to the conservation of sturgeon stocks (Figure 3), which will incorporate the latest techniques, methodologies and technologies for the formation of a unique live gene bank at European level. As this unit will develop into a station with the latest research facilities and concerns, it will be possible to elaborate the best techniques and methods of producing fingerlings for the support of wild sturgeon populations. This will also ensure a product of high ecological quality rather than quantity and will help to avoid problems that already occurred in the Caspian and Azov Seas due to detrimental practices in controlled propagation of sturgeons and massive releases of juveniles to support wild populations (Chebanov & Savelyeva 1999; Chebanov & Billard 2001; Secor et al 2008; Maltsev 2009).

The unit will consist of all the facilities necessary for sturgeon conservation in all developmental stages and necessary for the establishment of a broodstock, representing

the "live gene bank". Also an experimental pilot facility for propagation (Kynard et al 2011; Chebanov et al 2011) in compliance with all scientific regulations in the field, using low stocking densities, natural photoperiod and reducing other stressors will be included (Chebanov 2013).

The design of this conservation unit needs to include: broodstock ponds, transportation and unloading of broodstock, pre-spawning holding of broodstock (including long-term holding), hormonal stimulation of broodstock and production of gametes, egg fertilization and de-adhesion (unsticking), egg incubation, holding of prelarvae and grow out of larvae in tanks, rearing of fry in the grow-out ponds, pilot facilities for propagation (containers in breeding areas for hatching, and proper prelarvae and larvae development), culture and fishing of live food, systems that provide beck-up for water and electricity supply

A good example of the operating scheme of such a facility is the ”State Regional Centre for Sturgeon Gene Pool Conservation Kubanbioresursi” (Chebanov 2018) (Figure 4).

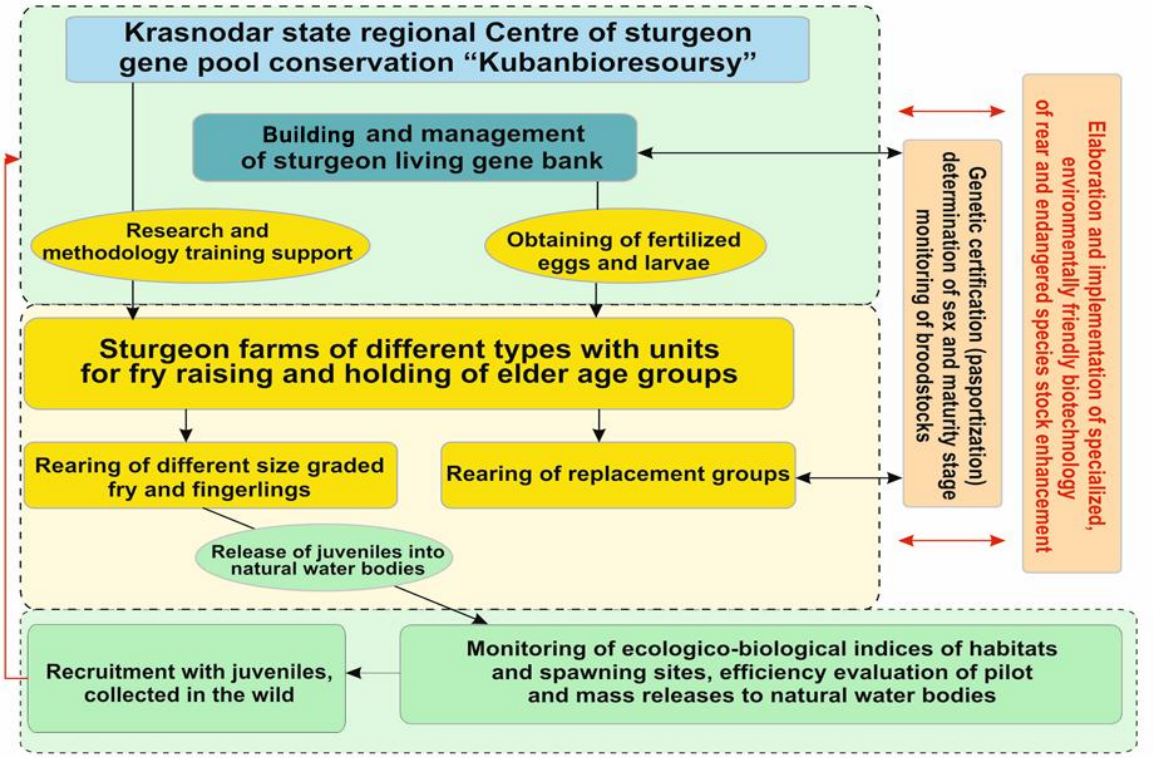

Figure 4. Scheme of «Centre for conservation of gene pool» activity (Chebanov 2018).

The facility will have the advantage of being able to have salt water from the Black Sea and fresh water from Danube, to ensure natural conditions of the environment. Sturgeons will be able to grow in basins of varying salinities corresponding to species and their respective stage of development (Williot et al 2009). The growth and health parameters of sturgeon in marine water are superior to those regarding the farming in fresh water (Zaharia et al 2011). This facility will also have the advantage to having access to adult and sub-adult sturgeons from the Black Sea, necessary to start immediately, after the finishing of the construction, the sturgeon broodstock.

B. Research and monitoring direction

Migratory fish still have many enigmas and some aspects of their behavior in the wild remain unknown. Over the last 100 years, a sum of factors has affected and intensified the dramatic decline in wild sturgeon populations. These can be classified in direct, indirect, and theoretical causes. The main direct causes: overfishing, dams (disruption of migration routes), poaching and bycatch, pollution, sediment excavation, hydro

morphological alterations of Danube. The main theoretical causes: the influence of the geo-political factors on the catches, insufficient or inaccurate commercial catches data, the economic part, and the luxury product. The main indirect causes: rivers hydrotechnical constructions (dikes and dams that have qualitatively changed the water geochemistry of Danube and main tributaries). The discovery and understanding of these life-cycle events and mechanisms could facilitate the identification of important causes that lead to a drastic decrease in populations and could generate optimal solutions for the restoration of wild populations. It is increasingly obvious, that besides the overfishing which is the main cause of the sturgeon stocks decline in the last century (Ionescu 2019), the deterioration of aquatic ecosystems by anthropogenic factors caused major changes in the physico-chemical, biological and hydromorphological parameters of the Danube and the Black Sea (Cociasu et al 1996; Humborg et al 1997; Garnier et al 2002; Saliot et al 2002; Tockner et al 2009; Bondar & Iordache 2016) which indirectly affect sturgeon populations. These indirect major causes have affected, in time, the natural productivity of the sturgeons. However, the exact cause-effect relations are still unknown, requiring a more detailed investigation of these elements for a better management of sturgeon population.

Lately, fundamental sturgeon research carried out at international level has made progress e.g. concerning the establishment of the biochemical elements of the larval nervous system, responsible in the first days of life of migratory fish for the olfactory imprinting of clues from spawning grounds (Kasumyan 2004; Camacho et al 2010; Kasumyan 2018).

Research and monitoring of migratory fish in Danube and Black Sea, has also made some progress lately, but there still is much to be clarified (some of them have been investigated on other migratory fish species), such as e.g.: identification and characterization of feeding sites for each species, feeding migration in the sea (Morteza et al 2016), "open water" orientation (Doving & Stabell 2003; Lindley et al 2008; Hauser et al 2017), endocrine and hormonal transformations during the open water migration, "homing" phenomenon and which are its underlying clues (Ishizawa et al 2010; Vrieze et al 2010; Ueda 2012; Keefer & Christopher 2013), up-stream migration-identification and specificity of sites for spawning and early development (Gessner & Bartel 2000), physicochemical, biological and mechanical characterization of ecosystems (Yamamoto, et al 2013), thus identifying the causes that affected the sturgeon's natural productivity, endocrine transformations during the downstream migration of the sturgeon YOY, telemetry for monitoring the migration along the Danube (marking with acoustic tags directly in the Black Sea would remove the intervention on the sturgeons during the migration and thus would be avoided the stress and physiological changes generated by it), the cycles of the period among reproductions (Bacalbasa 1997), the interspecific behavioral differences (Kynard et al 2002), genetic study of Black Sea sturgeon population (Ionescu et al 2018), bioacoustics (Carol & Catherine 2003; Meyer et al 2010; Meyer et al 2012; Bocast et al 2014), identifying the risks/hazards that affect each life cycle, determining the causes that affected and affecting the sturgeon populations, increased monitoring and research of these species in the sea, feeding migration, distribution, migratory species continues monitoring.

Fundamental progress in answering these questions could be made by the development and installment of such a station, as it would provide the opportunity to validate results from in-situ research directly by experiments in its ex-situ facilities, making use of its ideal geographical location and the biological material that is readily available. This underlines the complementarity of the two different branches (in-situ and ex-situ) for the validation of certain assumptions.

Certain studies and research that have been carried out at an international level already, can additionally serve as models for the future concept.

Design of the ISRCDS

Location. The ideal location for building the International Station for Danube Sturgeons Conservation and Migratory Fish Research is in the Northwest of Black Sea (Figure 5),

between the mouth of the Sf. Gheorghe and Sulina Arm, on the shore of the Black Sea at the marine liman.

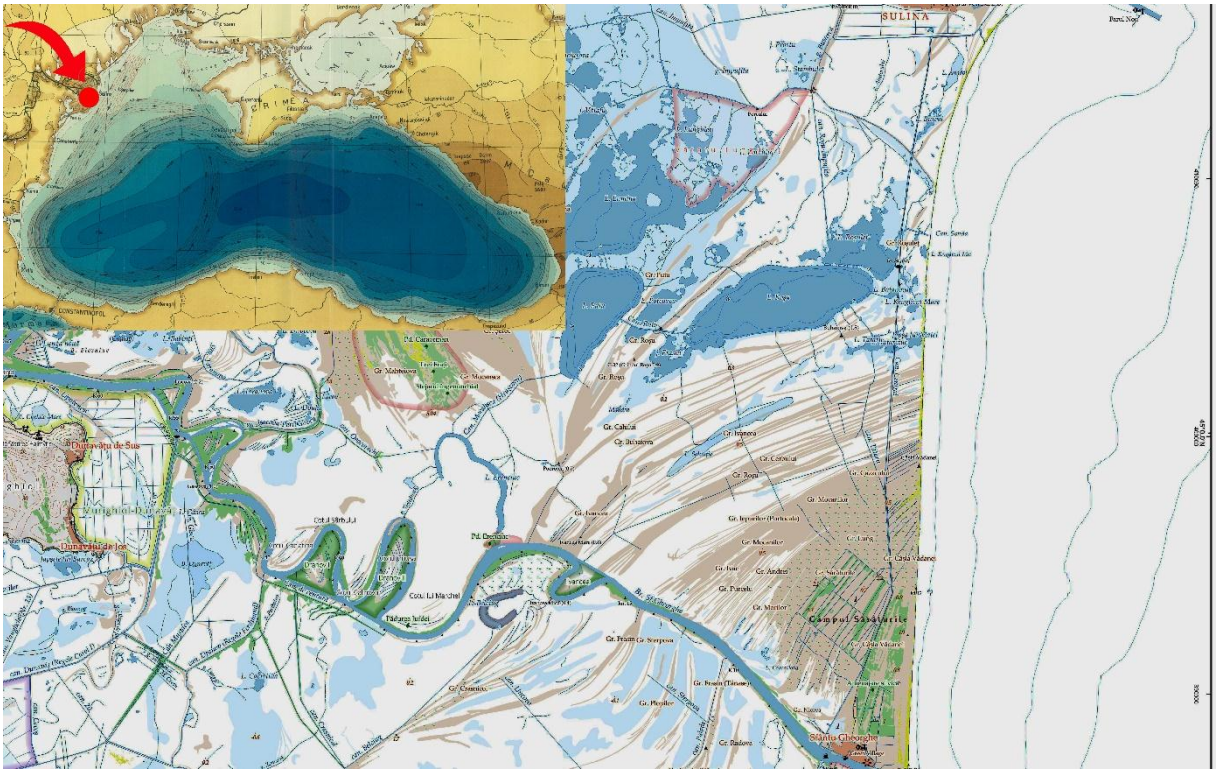

Figure 5. Black Sea ((Antipa, 1941), Ștefan Constantinescu 2020).

In addition to the remarkable geographic position, the choice of these locations also has a historical and scientific connotation, Sf. Gheorghe and Sulina village has a tradition of sturgeon fishing, also called the "European sturgeon capital". In the last 100 years, when sturgeon fishing was still legal, the largest amount of sturgeon from Romania resulted from commercial fishing in this area (Figure 6).

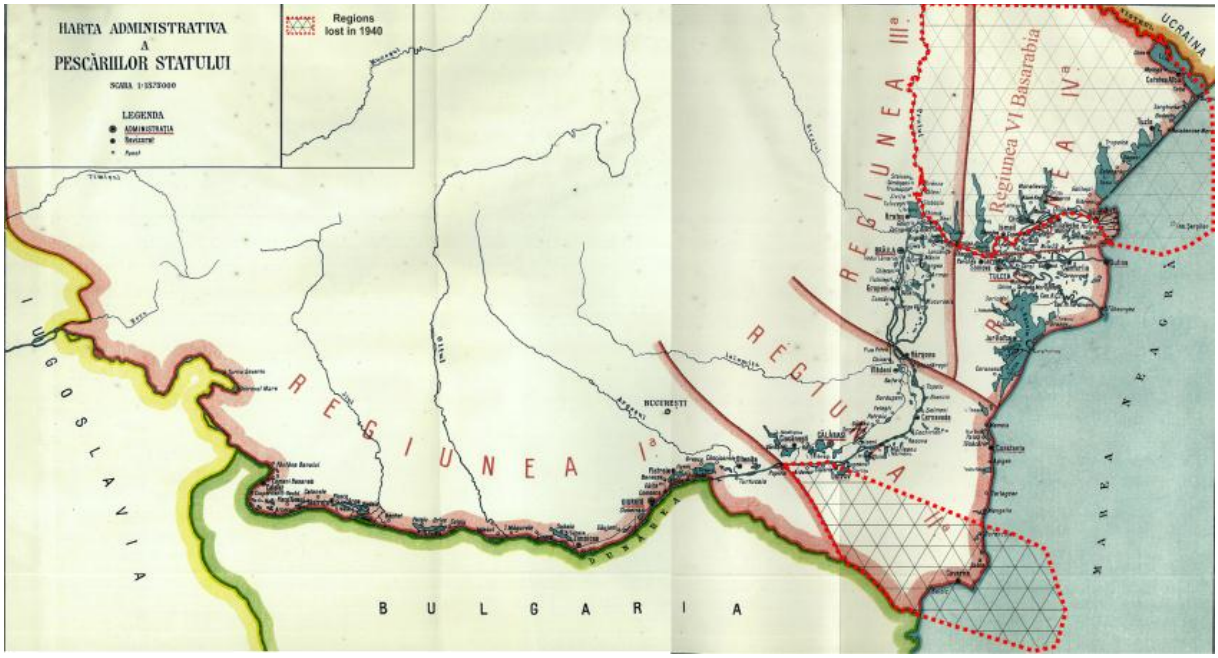

Figure 6. The division of the Romanian fishery into administrative areas in 1920.

In 1939, Romania, though part of an international political agreement, lost two territories that for the catches of sturgeon meant a loss of 14.53% (dotted red line) I also quantified the catches by regions from the 1920s to the 1924s, catches are recorded according to the five administrative divisions of the fishery by regions.

In the 1920s and in the 2003-2004, until the commercial sturgeon fishery was opened, the most abundant area in the production of sturgeon from commercial fishing was in the Black Sea. Although from Sulina to Perișor, with 76% (Figure 7) and 37% (Figure 8) respectively of the total catches of sturgeons in Romania. However, in the 1920s the production of sturgeons from commercial fishing was 439 tons year^{-1} and in 2003-2004 only 29 tons year^{-1} (Daia 1926; MPADR 2006).

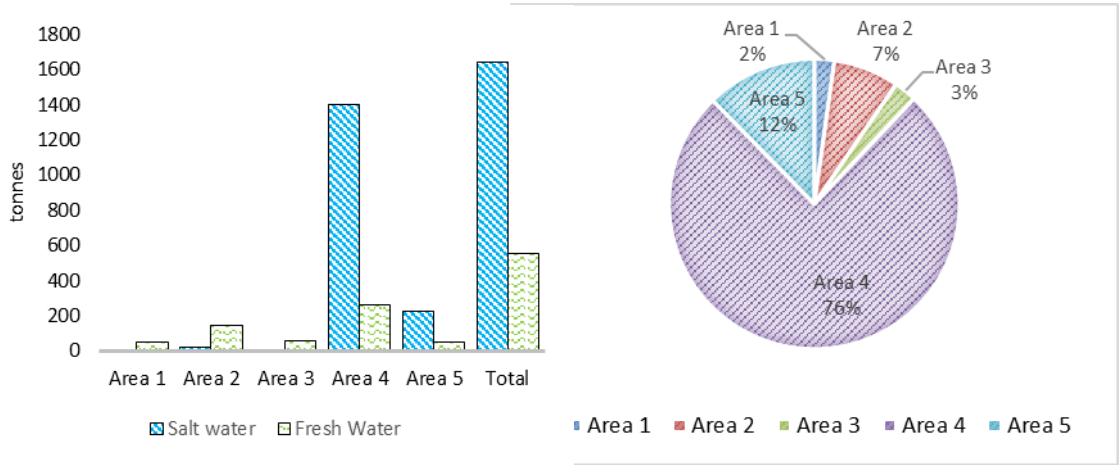

Figure 7. Commercial catches of sturgeon, by area and ecosystem, in period 1920-1924.

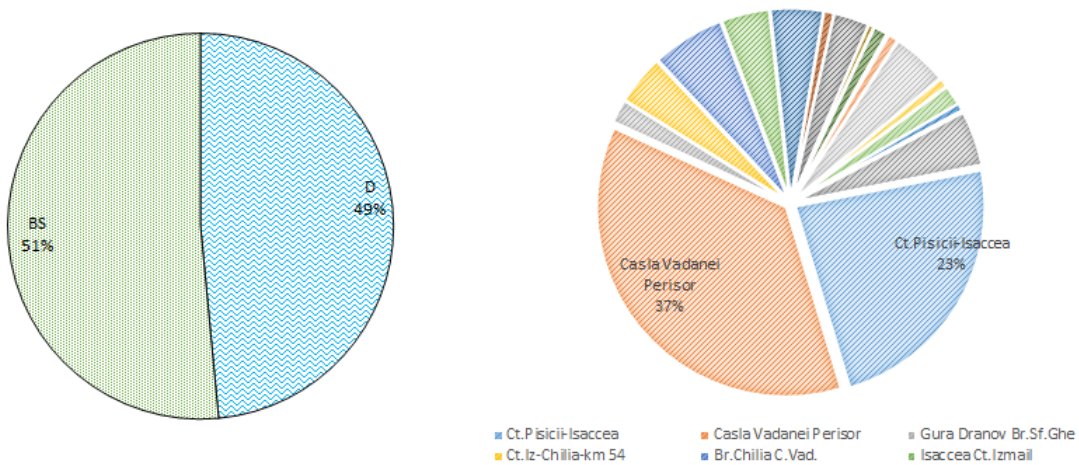

Figure 8. Commercial catches of sturgeon, by area and ecosystem, in period 2003-2004.

The designated location is in the seaside area, near the Sf. Gheorghe village, bordered to the East by the Black Sea and to the West by the Central Canal, which connects Sf. Gheorghe and Sulina (Figure 7 & 8).

Construction design. The International Station for Danube Sturgeons Conservation and Migratory Fish Research will be composed of the following elements:

1. The facility for conservation of sturgeon (Conservation Unit) will have five main elements:

A. Ponds for conservation and growth - earthen ponds covered by a special geomembrane (if it is found that the land has high permeability), with different sizes

and shapes, for the various species and classes of size/age. They will be endowed with specific equipment for water discharge and supply to ensure an appropriate hydrodynamic regime and system and fail-safe systems for flooding's and electrical power outage;

B. Facilities for breeding and pre-development of sturgeon - the breeding station will have facilities for egg incubation, holding of pre-larvae, grow out of larvae in tank sand rearing of fry in the grow-out ponds, equipped with all technical monitoring elements. It will also include experimental outdoor basins simulating conditions of the migration period by entering varying amounts of Danube water (Kynard et al 2011; Chebanov et al 2011). Other facilities and installations will enable a simulation of the natural environment and will allow experiments and research to be carried out in a multifactorial approach also with regard to the development of ecologically sustainable methods for controlled propagation under hatchery conditions, as well as for egg incubation in an adhesive state. Additionally, an artificial spawning ground will be developed ensuring optimal hydrological conditions for a simulated pseudo-migration of broodstock and including the possibility of annual renewal of artificial substrate and in-situ rearing of larvae (Chebanov et al 2011). Thorough research will also go into the possible deployment of special egg incubation stations for the purpose of supportive stocking or reintroductions. Here, fertilized eggs will be hatched and reared to juveniles in the direct vicinity of natural reproduction sites for the sturgeon to be released;

C. Facilities for the culture, procurement and preservation of natural live food - which will consist of fishing units equipped with the necessary tools for catching live food (fish, crustaceans, shells) in the Black Sea, equipment for the culture of live food (e.g. Daphnia, Artemia, Oligochaeta) and a station for briquetting, fast freezing and storage. This technological process will greatly reduce the possibility of food contamination and thus also the loss of priceless biological material;

D. Water supply and discharge installations - the technological facilities will be supplied with water from the Sea and the Danube, which will be directed to the Conservation Unit through the supply/discharge systems made up by a network of pipelines, connectors, control elements, pumps, etc. (flow-through systems). The supply water will be conditioned, so that all the water quality parameters to be maintained optimally throughout the year, regardless of the fluctuations caused by climatic factors. In addition, the removed wastewater will be treated before being discharged with ecological methods (e.g. reed). The installation will be equipped with system and fail-safe systems for flooding's and electrical power outage;

E. Power supply unit - In addition to the power supply of the medium voltage network, green energy systems will also be deployed (solar panels and wind turbine). The facility will also have a safety system for producing energy with fuel;

2. The administrative and research building will be composed of by 3 wings:

1) The eastern side of the building, the research and monitoring sector, restricted to researchers only, is made up of laboratories specifically endowed for being carrying out the in-situ and ex-situ fundamental research;

2) The western side of the building, intended for accommodation facility, conference room and offices necessary for employees, researchers and guests;

3) The middle side of the building will be arranged as a fishing museum with live transmission from the sturgeon ponds and objects that characterize the fishing communities, for a better awareness of the importance of sturgeons and their habitats. This will increase visibility and provide the Danube Delta with a new tourism objective.

All the materials used for the construction of this unit will be in accordance with the specificity of the area and the concrete will be used only for the resistance structure.

Discussion

The perfect place for sturgeons. Unique area to build a "Live gene bank". The facility will have conditions close to the natural ones (without stress on fry and broodstock, by

using low stocking densities, natural photoperiod, natural food, natural cycles of live, salt and fresh water).

Wild sturgeon with high genetic diversity. Access to sturgeon adults and sub-adults from the Black Sea without intervening in sturgeon upstream migration

Free sturgeon YOY (young of the year) for the recovery of wild sturgeon populations from Danube. The artificial reproduction will support a free annual sturgeon stocking program in Danube, with high genetically diversity of sturgeon fingerlings for each species, depending needs resulting from the research. The Station, through the research direction, will be able to make a continuously monitoring of these sturgeons in the Black Sea (Post-socking monitoring).

Danube water supply is very close and research facilities - artificial spawning ground with hydrological conditions of pseudo-migration of broodstock with the possibility of annual clearance of artificial substrate, rearing of larvae (controlled maturation without exogenous hormonal stimulation- development of ecologically sustainable methods for simulating artificial reproduction under the hatchery conditions).
Ponds for growth and conservation. Feeding with natural live food from the Black Sea, depending on species and age. Creating a facility for food preservation by quick freezing to avoid contamination.

Development of interdisciplinary studies and fundamental research and continuous monitoring - Full access to in-situ and ex-situ monitoring and research of marine and fluvial aquatic ecosystem and migratory fish species.

Low costs incurred with the building. This potential site have the access to utilities, access by boat to the Central Canal and the Black Sea, access to the road connecting Sf. Gheorghe and Sulina, access in the western part of the land to the medium voltage power line.

Conclusions. Envisioning and planning such an investment must consider the following aspects:

This Station will be dedicated for the conservation of biodiversity of wild sturgeons from the Danube and the Black Sea ”Live Gene Bank” and for the research and monitoring of migratory fish species in the North-West Black Sea and the Danube River;

Objectives of this Station need to be calculated for medium and long term (minim 20 years);

This Station must support a free annual sturgeon-stocking program in Danube;

The station will include containers located near to natural spawning site for river natural stream water smell to imprinting of yolk-sac larvae;

The station will have post-socking monitoring;

This Station it is a strategic investment for Danube Sturgeon and this aspect should be regarded as a matter of National, Regional and European Interest (the common aquatic resource of Danube and Black Sea riparian countries);

The station must be state-owned/European, set up by an international partnership (access grants required for the construction and ensuring maintenance) that includes state institutions from the countries concerned: Universities/Research Institutes (e.g. universities, institutes, Romanian Academy etc.), Agencies/Ministries (e.g. NAFA, DDBRA,

etc.), NGOs and organizations (e.g. DSTF, WSCS, WWF, ICPDR , IAD, etc.), Fishing Association;

The Station should be run by an International Board (maximal seven people) and International Scientific Council (members from each partner and international sturgeon experts), according to national and European law;

The administration of the Station should be carried out by a staff headed by a director who will be supervised by the International Board and International Scientific Council;

The design, construction and operation of this Station must be overseen by the international key experts fully involved;

The station must have cooperation and partnerships with international and national institutions with concern in conservation area or related fields. (e.g. National Research Institute of Science and Technology for Environment and Agriculture (IRSTEA), State Regional Centre for Sturgeon Gene Pool Conservation "Kubanbioresursi"; Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB); Sturgeon Monitoring Station from Isaccea; Research Centre "Danubius" Murighiol Subsidiary (INCDSB) etc.);

The station must have a collaborative project (grants) for research and monitoring of migratory fish species, implemented with entities from the riparian countries the Black Sea and the Danube;

The station must function according to the principle of a "living gene bank": molecular genetic characterization of breeders, a breeding plan, non-invasive techniques for monitoring of breeders, optimization of animal welfare, rearing and propagation with prolonged season of spawning, respecting the ecological requirements of the Danube and the Black Sea;

This Station will be in accordance with the new Pan-European Action Plan;

The development process must start as soon as possible;

Forming international partnership should begin as soon as possible.

Funding should be made by European funds (Eu Grants)/ or the financing line must be identified and the submission must be as soon as possible;

The cost of this investment is between 6-10 million euros depending on the construction solution (after the geotechnical, hydrogeological studies we can approximate the amount that will needed);

Maintenance/year will be approximately between 3-500 000 Euros (e.g. at the Kubanbioresursi the costs/year with maintenance between 0.5-1 million Euro/year for a 100 specimens of sturgeon broodstock (Chebanov 2018));

The financial effort for annual maintenance must be multinational, with the involvement of the governments / European Union / Partners.

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funding application and to materialize in a project. All rights reserved by the author. Also, I am thankful to Ioan Valentin Petrescu-Mag because he helps me with this paper.

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Annexe 1

All the 27 species of sturgeons and paddlefish are represented in the artwork "Sturgeon Species". This is made by the international artist Florian Doru Chrihană in collaboration with Tudor Ionescu, according to the CITES Identification Guide – Sturgeons and Paddlefish and is part of the collection "Centuries of Danube Sturgeon" (Ionescu 2020). Unfortunately, in early 2020, Chinese paddlefish (*Psephurus gladius*) was declared extinct by Chinese officials.