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CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE
AND NATURAL HABITATS

Standing Committee

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PRELIMINARY DOCUMENT

Draft Action Plan for the conservation and restoration of the European Sturgeon (*Acipenser sturio*)

FAO

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Document prepared by
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SOMMAIRE

1. GENERAL PRESENTATION

1.1 Introduction

The European sturgeon (*Acipenser sturio* L.1758) used to be one of the most common sturgeon species in world, with the largest area of distribution. His status has greatly changed and it is now the most threatened fish in Europe. It is in a critical danger of extinction (Rochard *et al.,* 1990). Yet, there was a time when it used to be the most represented sturgeon species in Europe, as its vernacular name "common sturgeon" indicates.

A stable and fertile population of European sturgeons would provide important ecological goods and services, as follows:

First, due to his complex life cycle and to his large size, this fish would be a good and long term indicator of the good ecological status of the waters as established by the water framework directive.

Second, the European sturgeon has a strong symbolic and heritage value. It sustains a lot of legends and is still very present in our minds. It is the largest fish naturally present in the Western European waters.

Finally, there used to be a lot of fishing on this species, which was later banned due to the scarcity of the animal. But on the long term, a restored population could make possible an economically sustainable halieutic exploitation.

These are all good reasons that justify saving the European sturgeon and on which this draft action plan for its restoration is based.

1.1.1 Phylogeny

Sturgeons and the closely related paddlefishes belong to the class of bony fishes, the Osteichthyes, within which the subclass Actinopterygii (ray-finned fishes) includes the Chondrostei and the order Acipenseriformes. The order Acipenseriformes is composed of three families, of which the family Acipenseridae (sturgeons; 26 species in the genera *Acipenser*, *Huso*, *Scaphirhynchus* and *Pseudoscaphirhynchus*) and the family Polyodontidae (paddlefishes; containing the monospecific genera *Polyodon* and *Psephurus*) are still represented by living species. The third family, the Chondrosteidae, is now extinct.

Acipenseriformes are confined to the northern hemisphere. Biogeographic analysis suggests that the order originated in Europe about 200 million years ago and that early diversification took place in Asia. The majority of species occur in the Ponto-Caspian region, one third in North America and the remainder in East Asia and Siberia.

It is generally accepted that eight species of Acipenseridae are, or were, sympatric in European waters:

Acipenser gueldenstaedti (Danube or Russian sturgeon)

Acipenser nudiventris (Fringebarbel or Ship sturgeon)

Acipenser ruthenus (Sterlet)

Acipenser stellatus (Stellate or Starred sturgeon)

Acipenser sturio (Common or European sturgeon)

Acipenser oxyrinchus (American Atlantic sturgeon)

Acipenser naccarii (Adriatic sturgeon)

Huso huso (Beluga or Great sturgeon)

1.1.2 Description of the species

The body of the sturgeon is long and covered with 5 rows of longitudinal osseous plates. The skeleton is partly ossified. The back is grey-brown with green reflections. The belly is yellowish with silver reflections. The nose is pointed. The infer mouth (the ventral side of the head) looks like a protactile tube and is preceded by 4 afferent wattles. The tail is asymmetrical. The animal can be as long as 3.5 meters and can weight up to 300 kg. Some exceptional catches have reported fishes of 5-meter long.

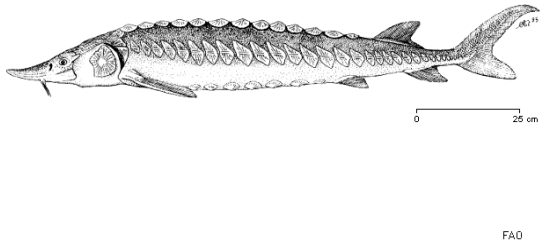

Figure 1: representation of an Acipenser sturio (source Bauchot 1987)

1.1.3 History and repartition

The European sturgeon (Acipenser sturio) is a migratory species historically found in all Western Europe, in the Black Sea, in the Mediterranean Sea, along the Atlantic coasts, from Portugal (South) to the Scandinavian peninsula (North), in the North Sea and in the Baltic Sea.

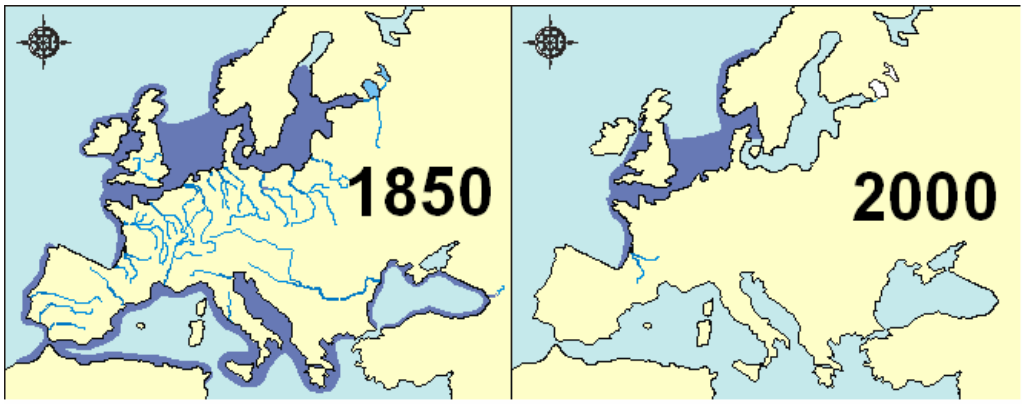

Figure 2: in dark, the areas where Acipenser sturio could be found in 1850 and 2000 (source: P. Elie)

Some specimens had also been reported along the coasts of Iceland and of the White Sea (North West of Russia), as well as along the Atlantic and Mediterranean coasts of Northern Africa (Magnin, 1962; Holčik *et al.,* 1989).

The species was abundant along the coasts and in most of the biggest European rivers (with about 30 large catchment areas).

Of all European sturgeon species, *sturio* once had one of the largest areas of repartition (Holčik *et al.,* 1989).

Its decline began during the late 19th century. In the early 1970s, two small reproductive populations remained, one in the Gironde estuary (France) and the other in the Rioni river (Georgia; Castelnaud *et al.,* 1991; Debus 1997).

Ten years later, in 1980, there was only one population left. All the other populations had disappeared within a century (Almaça & Elvira, 2000; Fernandez-Pasquier, 2000; Van Winden *et al.,* 2000). Despite some uncertainties about the existence of a few remaining sturgeons in the Black Sea, it is certain that there is no reproduction in this area. Indeed, the last confirmed catch of a European sturgeon in the Danube occurred in Serbia in 1954 (Bloesch *et al* 2005).

1.1.4 Current situation

The current situation is tragic. The adults, only a few individuals, are scattered in a very large area of repartition: from the Bay of Biscay to the North Sea (Rochar *et al.,* 1997). All indicators concur: the species is in critical danger of extinction. Today, the last residual population breeds only in France, in the Gironde, Garonne and Dordogne basins (Williot *et al.,* 1997).

The natural population of fishes old enough to breed is declining at an alarming pace. It is estimated that there are a few hundreds to a thousand fishes left. Between 1951 and 1980, the catches of sturgeons on the Gironde, Dordogne and Garonne rivers had dropped to 94%, from 2500 catches per decade to only 150. In 1982, the stock decline being obvious, the European sturgeon was declared a protected species. But the drop in the number of fishes continued, as the number of captures for scientific purposes indicates: from under 10 per year in the 80s and nil since the late 90s.

After 20 years of research in the Gironde estuary, only 41 specimens have been caught. Among them 10 were females of which and among females, only 2 were in an optimal state for reproduction between 1981 and 1995. The latest capture of a female made possible the first breeding in artificial conditions . It gave birth to the specimens that are bred in the CEMAGREF and IGB centres.

It has been observed that reproduction in the natural environment is extremely rare, which is the most worrying issue. The two latest known natural reproductions of Acipenser sturio took place in 1988 and 1994… More than 10 years ago (Williot *et al,* 2002).

1.2 Life cycle

The European sturgeon is relatively bad known. It is a benthic fish and its observation is rather difficult, requiring expensive equipment. Moreover, the life cycle of this animal is both long and complex, which makes it difficult to research. The knowledge of the life cycle of this species is really important to understand why its population is declining so fast. Just like a lot of large animals, the European sturgeon can live many years and reaches maturity at a late stage of its life. This is why when there are no adults left, it takes a lot of time to restore the stocks.

The European sturgeon is a diadromous migratory species, which means that it lives successively in fresh water, in estuaries and in the sea.

Our knowledge has been acquired mainly thanks to the sturgeons from the Gironde estuary. Some data may be specific to this region.

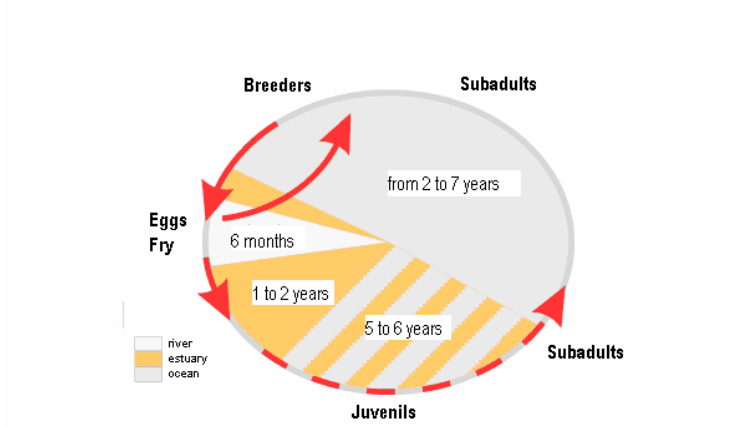

Figure 3: Biological cycle in the Dordogne basin (source EPIDOR)

The biological cycle of the European sturgeon (figure 3) is made up of several stages. The first stage takes place in the rivers. Then, aged 6 months, young fishes go downstream until they reach the estuary. The young will stay there 1-2 years. Between the age of 2 and 7, the fishes alternate between the sea and the estuary and stay close to the continental shelf. Aged 7-8, they become sub-adults and migrations to the estuary are much more rare. After a few years in the sea, the fishes become mature and swim upstream to breed.

1.2.1 Fry stage

In spring, after a 4-5 daylong incubation (Williot *et al.* 2000), the young fishes emerge from their eggs. It is the fry stage. It takes place in fresh water, in the lower part of the catchment areas, close to the spawning grounds where the fry were born. They gradually grow there during six months or so (Magnin, 1963; Kinzelbach, 1987; Holcik and others, 1989). Their behavior during this stage of their life is not well known. It seems that the young sturgeons feed themselves mainly with macro-invertebrates, notably with oligochetes and chironomides larvas. They will keep a similar nutrition all life long. The young fishes look in the sea floor for small invertebrates that they can detect thanks to the sensitive wattles near their mouth. In winter, the fry divert and slowly reach the estuary.

1.2.2 The juvenile stage

This life stage of the European sturgeon has two phases. The first lasts two years and takes place exclusively in the brackish waters of the estuary. The young fishes progressively acclimate themselves to the salinity rates (from 5 to 25‰). It has been observed that they can be found in higher quantities in some preferential areas with sandy floors (Rochard *et al,* 2001) where the depth is higher than five meters and the temperature is about 20°C (Castelnaud *et al,* 1991). The second phase of this stage, when the young fish are between 2 and 8 years old, is the beginning of a migration to the ocean with regular returns to the estuary.

1.2.3 The sub-adult and adult stages

From 8 years on, the sturgeon becomes a sub-adult. It has the same characteristics as an adult but it does not breed. Both adults and sub-adults live exclusively in the sea. All available data indicate that during its stay at sea, *A. sturio* is a littoral species limited mainly to estuaries with muddy bottoms. This sea life has never been directly observed and the only data available come from catches made by fishermen. In two thirds of the cases sub-adults were found where the water was about 40 to 100 meters deep (Rochard *et al,* 1997), on the continental shelf, near the coasts. Yet, some older and larger specimens have been caught in the Adriatic Sea where water was up to 200 meters deep (Holičk & coll., 1989).

The fishes reach ripeness between 10 and 12 for males and between 13 and 16 for females (Williot *et al,* 1997). Between February and March adults migrate to the spawning grounds. Sturgeons do not breed every year and the pace of their reproductive cycle as well as the factors that can have an impact on the spawning migration are not very well known. It is believed that males swim to the spawning grounds every two years on average, way less often for females (Williot 2006). This difference could explain why catches of males in fresh waters are 3 to 4 times more common than the catches of females. The spawn starts one month after the spawning run. It takes place in well-known rifts, in the lower basins of the rivers. Their floor is made of shingles and gravels subject to strong sea currents.

1.3 Risks and threats affecting the natural population

Nowadays the species is close to extinction. Natural stocks are at an extremely low level. The European sturgeon is critically vulnerable. The threats are the same for all catchment areas. However their degree of importance varies from one area to another. They are well known in the Gironde basin but are more difficult to estimate in the basins where the species does no longer exist.

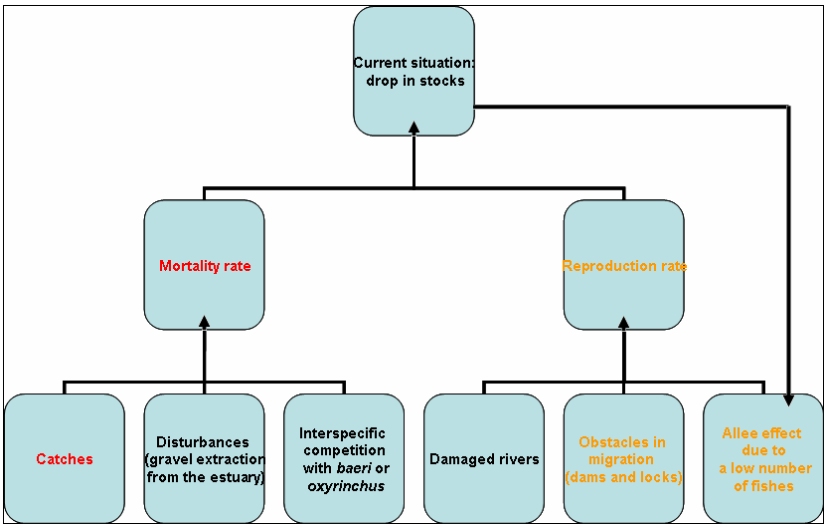

Figure 4: reasons for the fragility of Acipenser sturio. The colors show the degree importance of each cause: red for major, orange for important and black for "non-limiting" factor.

1.3.1 A fragile population

A small population is more fragile than a large one. Its life environment is always disturbed (environmental stochasticity), hence an alarming risk of extinction. Indeed, the larger the population, the wider its genetic diversity, which means that if the environment changes there will be more individuals endowed with the proper genetic equipment to survive this change. The longer a delicate situation lasts, the higher the risk of extinction.

1.3.2 Allee effect, drops in stocks accelerate extinction

There is a threat directly linked to the very low levels of population stocks. This is the Allee effect (Myers, *et al.*, 1995). It foresees a negative growth rate (a drop in the population) even if all environment factors were favorable. This happens when the population density in the area is not sufficient to ensure the survival of the species. In the case of the sturgeon, it means that the migrating animals cannot find a sexual partner. In other words, the chances for a male and a mature female to meet in a spawning ground are very low because of the whole population's small size The Allee effect is all the more relevant for this species since its adults do not often migrate to breed. It is estimated that females try to mate only twice or three times per decade. Indeed, the egg-laying has become very rare: the two latest records date back to 1988 and 1994.

It should be noted that this threat is not imputable to humans. This is a mechanical effect in the decrease of the population, which creates a vicious circle leading to the extinction of the species. Fortunately, the long life of the European sturgeon keeps this species alive without any recent reproductive event.

1.3.3 Deteriorated rivers

Rivers are crucial for the species because they host the reproduction areas. The deterioration of these would-be reproduction sites for adults and repartition areas for young fishes has a strong impact on the success of breeding.

This deterioration can be physical, as is the case with the Rhine where changes in its flow have caused the disappearance of many spawning grounds (Kinzelbach 1987). River modification can also result in the loss of, or changes to, macro-invertebrate fauna and also disrupts the connectivity of rivers and their floodplains

But it can also be chemical. there is a potential alteration of the tissues and physiology of fish and especially the reproductive capability of populations due to the accumulation of toxic substances in

river and sea-shelf sediments, and subsequent up-take through the food-chain (Akimova & Ruban 1996; Bickham et al. 1998). Since endocrine disruptors, hormone active substances (HAS) and persistent organic chemicals (POC), such as PCPs and PAHs, are known to stress fish populations worldwide, it can be considered that sturgeons in the Danube River Basin are also affected. Sub-lethal effects may include, among others, damage to liver and gill tissues, altered enzyme activity, diminished condition (health) index, hermaphroditism, degeneration and absorption of gametes, as well as amitoses in oocytes, leading to the reduction of reproductive potential of populations. In the Gironde estuary, the concentration of cadmium is 10 to 20 times higher than in the other Atlantic estuaries (Maurice 1994). This concentration could be harmful to sturgeons especially as far as their kidneys are concerned (Williot, *et al.,* 1997).

1.3.4 Obstacles to migration

The sturgeon is very sensitive to obstacles on the rivers. As an anadromous migratory fish, it swims upstream to breed. Constructions such as dams or locks can reduce to nothing its will to mate. In such cases reproduction is of course impossible (reproduction rate is equal to zero).

This was demonstrated in the case of the Volga River (Russian Federation), where the majority of spawning sites for *H. huso* were lost after the construction of the Volgograd dam. For the Danube River and Black Sea populations of migratory sturgeons the extensive morphological damage to the Danube and its tributaries, together with high levels of pollution, have severely impacted the sturgeon populations of the whole Basin. In particular, the completion of the Iron Gates dams in the 1970s and 1980s meant the loss of important spawning sites in the Middle Danube River up to Gabčíkovo. As early as 1890-1896, the first river regulation in the Djerdap region already partially prevented sturgeons from reaching the upper part of the Danube River (Lenhardt et al. 2005).

On the Garonne and Dordogne basins, there have been no further obstacles to migration since the building of the Bergerac dam on the Dordogne in 1851 and the Golfech dam on the Garonne in 1971. These obstacles are upstream enough to allow the reproduction of about 200 couples every year.

1.3.5 Disturbances

The extraction of gravel or sand disturbs the estuarian ecosystems (Castelnaud *et al,* 1981). It changes the environment both in chemical and physical terms:

- A chemical change with a diminution in the oxygen rate when some organic material is rejected.
- A physical change with the modification of the stream beds. Sometimes, due to the deepening of the channels, some muddy plugs form at the bottom.

The impact of gravel and sand extraction is not fully understood yet. Thus, gravel extraction is an additional potential threat for the sturgeon (Lepage & Rochard, 1997). Though it is not the major threat, it is considered as an aggravating factor.

1.3.6 Introduction of exotic species

The release of allochthonous species or stocks must also be considered as a potential threat, since the introduction of exotic species may have negative effects on the ecosystem. Natural hybridisation can occur between all sturgeon species, which facilitates the artificial propagation of hybrids, but may be ecologically disastrous when allochthonous species, genotypes or hybrids are released into the environment.

It has also been reported in the literature that stocked juveniles of hatchery origin are not adapted to conditions in natural riverine/marine surroundings (Freyhof & Serov 2000).

For example, studies of the effective and genetic consequences of the introduction of *A. stellatus* from the Caspian Sea into the basin of the Sea of Azov revealed the ineffectiveness of the stocking programme, since the introduced stocks displayed less successful reproduction (Tsvetnenko 1993).

The negative effects of large-scale stocking and the introduction of exotic stocks that are not genetically adapted to the recipient river system (e.g. by the import of fertilised eggs or juveniles from other watersheds) have already been documented for other river basins (Tsvetnenko 1993; Ludwig et al. 2002). These effects include the loss of genetic variability, or the disappearance of whole forms.

Thus, a major demand on artificial propagation and hatchery management practices must be the preservation of the genetic heterogeneity of sturgeon populations (Chebanov & Savelyeva 1999). The question of whether or not the sturgeon specimens selected for re-introduction are genetically adapted to the recipient river system is not a trivial one. This is demonstrated by the ongoing sturgeon restoration programme in the Baltic Sea, where the North American species *A. oxyrinchus* is now believed to be the native species (having invaded the Baltic about 1,200 years ago) and not the European species *A. sturio* that was nearly extinct by the 1950s (Ludwig et al. 2002). New methods of DNA analysis may be applied to centuries-old museum specimens.

There are two potential sources of introduction of exotic sturgeon in Europe. The first comes from holders of aquarium or garden basins that throw sturgeon in rivers when they become too large. The second is represented by enclosed water for fishermen (Britton & Davis 2006) or caviar producing farms. Those activities are not fully secured and escapes often occur especially during floods

In December 1999, an accident occurred in a fish-breeding farm on the Dordogne river. Some thousands of *Acipenser baeri*, the Siberian sturgeon, an exotic species, managed to escape and reach the environment. If there is a risk of competition between the baeri and the sturio, the risk of a genetic pollution is equal to zero though, thanks to a difference in the ploidies (Williot, 2006). Their real impact has not been measured yet, but there was no evidence of reproduction or hybridization so there should not be long term impact in this case.

1.3.7 Catches

Catches of sturgeons are considered as one of the main causes of the increased scarcity of the European sturgeon. They are all the more harmful to the species since they mostly affect sub-adults, thus threatening the possibility for this small population of fishes born from a natural reproduction process to reach the river and spawn.

Considering the low number of fishes, there is currently no fishing of sturgeon, although some catches still happen. These are of several kinds that should be analyzed and treated separately.

The first kind is illegal fishing. Of course there are no accurate statistics related to this kind of fishing. It is estimated that a few to a few dozens fishes are captured every year. Most of the time these catches are deliberate acts of illegal fishing, local cases that indicate remains of traditional, historical and/or cultural practices. They take place at some specific times of the year (mouvée de la Saint Jean on the Garonne for instance).

The second kind is accidental captures of sturgeons while legally fishing and targeting several demersal species of fish (sole, ray, etc.) and shellfish within the sturgeon's range area. Most of the fishing concerned involves the use of beam trawlers, trammel nets and gillnets(Rochard *et al,* 1997). Sometimes the sturgeon is kept on board as a trophy or just by curiosity and it is a victim of its imposing size and strange look. In 1998, from Spain to England, the number of catches was estimated to be 450, with a rate of 57% not surviving.

Finally, the last type is also the most limited: only a few sturgeons per year (40 in 20 years, Williot 1997), and close to zero nowadays, are related to samplings for scientific purposes.

The impact of marine catches on sturgeon populations is also documented by the fact that a temporary recovery of sturgeon stocks was observed after the implementation of a moratorium on marine sturgeon harvest in the Caspian Sea in 1962. Estimations for the size of losses from the Gironde population of the European sturgeon are difficult but can include 100 to 400 individuals annually.

2. LEGAL ASPECTS

The European sturgeon is currently protected by many international conventions.

2.1 Global instruments

The states concerned by the European sturgeon are all Contracting Parties to a numer of international conventions and are therefore bound by their provisions.

2.1.1 The Convention on Migratory Species (CMS, Bonn)

On October 2005, at the CMS 8th Conference of the Parties held in Nairobi, Kenya, the European sturgeon was transferred from Appendix 2 to Appendix 1, which lists endangered migratory species. Parties must therefore strive to:

- preserve and when possible and appropriate, restore the species habitats, which is important to prevent their extinction;
- prevent, eliminate, compensate or minimise, when appropriate, the negative effects of activities or obstacles which might seriously interfere with or prevent the species migration;
- prevent, reduce or control the factors that endanger or are likely to endanger even more the species.
- Furthermore, Resolution 7.7 on the implementation of existing agreements and the development of further agreements, invites the States in the distribution areas of the sturgeon species included in the annexes of the CMS, to take the lead to develop an appropriate CMS instrument on sturgeons.

2.1.2 The Convention on International Trade in Endangered Species (CITES, Washington)

The European sturgeon is listed in annex 1 of the Convention. Its trade, under any form, must be subject to a particularly stringent regulation so as not to endanger even more the survival of the species. It should be authorized only in exceptional cases, such as for scientific research.

Resolution Conf. 12.7 on the conservation of and the trade in sturgeons and paddlefish encourages the following actions :

- scientific research and adequate monitoring of the status of stocks,
- curtail the illegal fishing of and trade in sturgeon and paddlefish specimens;
- explore ways of enhancing the participation of the representatives of all agencies responsible for sturgeon and paddlefish in fisheries conservation and sustainable use programmes of these species;
- promote regional agreements between range States of sturgeon and paddlefish species aimed at proper management and sustainable use of these species;
- for range states in the Eurasian region, take into account the recommendations in document CoP12 Doc 42.1 when developing regional conservation strategies and action plans.

The EU regulation No. 338/97 adapts to Community Law the goals, principles and provisions of the CITES Convention. As an endangered species , the European sturgeon is listed in Annex A of the Regulation. This regulation has been substantially amended by Regulation 865/2006, of 4 May 2006.

2.1.3 The Convention on Wetlands (The Ramsar Convention)

Since 1996 (Resolution VI-2), specific criteria relevant to fishes aim at identifying wetlands of international importance according to Articles 2(4) and (5) of the Convention (criteria 7 and 8).

In addition, the Convention requires Parties to consult with each other about the implementation of their obligations, in particular when a river basin is shared between them. They shall endeavour to coordinate and support present and future policies and regulations concerning the conservation of wetlands as provided in Article 1 of the treaty, especially their fauna (Article 5).

Resolution IX-4, of November 2005, on the Ramsar Convention and conservation, production and sustainable use of fisheries resources. In paragraphs 30 and 34, Parties are invited to take measures in the framework of their integrated management of watershed and coastal zones, aimed at :

- maintaining or reinstating aquatic biota migration pathways
- reducing the impacts of point source and diffuse pollution in all its forms
- protecting critical spawning and nursery grounds
- restoring relevant habitats where these have become degraded
- controlling the accidental movement of species
- avoiding introduction of invasive and/or alien species

2.2 Regional instruments

2.2.1 The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

The European sturgeon is listed as strictly protected fauna species (Annex II). Each Contracting Party shall take appropriate and necessary legal and administrative measure to ensure its conservation and in particular prohibit (Article 6):

- its deliberate capture, keeping and killing ;
- deliberate damage to or destruction of breeding or nesting sites ;
- the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention ;
- the deliberate destruction or taking of eggs from the wild or keeping these eggs even if empty ;
- the possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof, where this would contribute to the effectiveness of the provisions of this article.

Parties have to coordinate their efforts to ensure the species conservation throughout its range (Article 10). They commit themselves to:

- co-operate whenever appropriate and in particular where this would enhance the effectiveness of measures taken under other articles of this Convention, and to encourage and co-ordinate research related to the purposes of this Convention.
- encourage the reintroduction of native species of wild flora and fauna when this would contribute to the conservation of an endangered species, provided that a study is first made in the light of the experiences of other Contracting Parties to establish that such reintroduction would be effective and acceptable (Article 11).

The Convention's Standing Committee has approved the initiative of developing an action plan for the Western European sturgeon (*Acipenser sturio*) and Recommendation No. 59 (1997) provides guidelines on this issue.

In addition, the Standing Committee of the Bern Convention has adopted Recommendation 116 (2005) on the conservation of sturgeon (*Acipenseridae*) in the Danube River Basin, asking Parties to consider drafting and implementing national action plans for the sturgeon species listed in the Appendix to the Recommendation, and to take note, in that context, of the Action Plan for the Conservation of Sturgeons (*Acipenseridae*) in the Danube River Basin.

2.2.2 The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention)

The OSPAR Biological Diversity and Ecosystems Conservation Strategy (Paragraph 2.2) comprises four elements: ecological quality objectives, activities focusing on species and their habitats; the creation of an ecologically coherent network of well-managed marine protected areas, and eventually programmes to reduce the potential detrimental effects of human activities in the maritime areas covered by the Convention. Under this strategy, projects and recommendations have been established for the management of the European sturgeon (BDC 05/4/2-E, 61-69.), considered as priority species by the Convention. These projects are designed around six themes:

- ex situ conservation measures which guarantee the genetic resources of the last natural population;
- controlled reproduction programmes that take into account genetic aspects;
- pouring-out of young specimens into two appropriate hydrologic schemes in order to at least reduce the risks of species extinction;
- effective protection of the species through fish farming;
- effective protection and restoration of recognised or potentially threatened species habitats of the species;
- prohibition of the pouring-out of non native sturgeon species;
- improvement of the coordination and cooperation of sturgeon restoration national programmes, integration of sturgeon restoration into other protection and restoration activities (ex : salmon, eel, habitats, protected areas, etc.);
- necessary ex situ protection measures, before undertaking any potentially successful sturgeon restoration plan.

2.2.3 The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention)

At this stage of consideration of the potential restoration of the European sturgeon in the river Rhône, this legal instrument and the related "Barcelona Protocol" of 10 June 1995, are mentioned for information. They only concern Mediterranean countries where the species historically occurred, and for the part of their territories located in this coastline, particularly Spain, France, Greece and Italy. Their main objective is to set up a list of Specially Protected Areas of Mediterranean Importance (SPAMI), including sites "*particular importance for the conservation of the constituent elements of the biological diversity of the Mediterranean Sea, comprising ecosystems that are specific to the Mediterranean region or endangered species habitats or representing a particular scientific, aesthetic, cultural or educational interest"*. The activity programme of the Convention, for the 1996–2005 period, includes two priority fields of action likely to be implemented on sturgeon: the management of genetic resources and marine biological resources.

2.3 European Community Law

All the concerned countries of the Atlantic coast are member of the European Union. Only part of the Mediterranean countries have joined, with the exception of the African countries only concerned at very long term by the potential restoration of the species in the Mediterranean Basin.

The European sturgeon is a species for which the European Community has a particular responsibility since the whole range of the species is comprised within the limits of Community territory, especially France as it hosts the only known reproductive species population. Community Law in this matter essentially rests on the Habitats Directive.

2.3.1 The Habitats Directive

The European sturgeon is listed among the animal species of Community interest (Annex II) which conservation required the designation of Special Areas of Conservation (SAC). As regards European sturgeon, eleven areas have been designated up to now and six others are in the process of

being approved. The species is also included in the list of animal species of Community interest in need of strict protection (Annex IV).

Article 6 is the main provision of the Habitats Directive targetting species conservation scheme. It provides that Member States shall take appropriate steps to avoid the deterioration of natural habitats and the habitat of species, as well as disturbance of the species for which the habitat has been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive.

The transposition of this Article into the national legislation of the Member States constitutes a strict obligation. Nevertheless, lack of transposition does not free those States from their obligations derived from this instrument.

The particular issue of natural marine habitats and marine species or, as in the case of sturgeon, amphibiotic species has to be considered. Discussions are being conducted within the European Commission to extend the NATURA 2000 network to marine environment. By 2005 these discussions must lead to:

- define types of marine habitats;
- establish selection guidelines for marine SAC;
- provide several leads of reflection on the issues related to the management of such areas.

Table 1. NATURA 2000 Sites for *Acipenser sturio* (Source : CTECN/AEE, June 2005). Sites marked are waiting for endorsement.

Pays	Code du site	Nom du site	Superficie	Zone		
				Atlantique	Continentale	Méditerranéenne
Italie	IT2080002	Basso corso e sponde del Ticino	8564		X	
France	FR7200700	La Garonne	5220	X		
France	FR7200660	La Dordogne	5694	X		
Espagne	ES6150018	Rio Guadiana et Ribera de Chanza	1545,81			X
Espagne	ES6150010	Andevalo occidental	52901,71			X
Espagne	ES0000024	Donana	112355,2			X
Espagne	ES6150019	Bajo Guadalquivir	4113,94			X
Italie	IT2080014	Boschi Siro Negri e Moriano	1352		X	
Grèce	GR2310001	Delta Achelou, Limnothalassa mesologgiou-Aitolikou, Ekvoles Evinou, NisoI Echinades, Nisos Petalas	35588,73			X
Italie	IT2090006	Spiagge fluviali di Boffalora	172		X	
Italie	IT4060013	Po da Golena Bianca a Isola Bianca	616		X	
Italie	IT2090007	Lanca di Soltarico	160		X	
Italie	IT20B0001	Bosco Foce Oglio	105		X	
Italie	IT3270017	Delta del Po	22408		X	
Italie	IT4010018	Fiume Po da Rio Boriacco a Bosco Ospizio	6118		X	
Italie	IT4060005	Sacca di Goro, Po di Goro, Valle Dindona, Foce del Po di Volano	4859		X	
Italie	IT2080019	Boschi di Vaccarizza	465		X	

Table 2. NATURA 2000 Sites for *Acipenser nacarii* which are interesting for *sturio* (Source : CTECN/AEE, situation June 2005)

Type	Code du site	Nom du site	Superficie	Zone		
				Atlantique	Continentale	Méditerranéenne
I	IT3270017	Delta del Po	22408		X	
G	IT4060013	Po da Golena Bianca a Isola Bianca	616		X	
C	IT4060005	Sacca di Goro, Po di Goro, Valle Dindona, Foce del Po di Volano	4859		X	
E	IT2080002	Basso corso e sponde del Ticino	8564		X	
C	IT4010018	Fiume Po da Rio Boriacco a Bosco Ospizio	6118		X	
C	IT3320037	Laguna di Marano e Grado	16288		X	
G	IT2080019	Boschi di Vaccarizza	465		X	
K	IT2080014	Boschi Siro Negri e Moriano	1352		X	
B	IT20B0001	Bosco Foce Oglio	105		X	

2.3.2 Community regulation in response to incidental catch issues

For information purposes, two Community legal instruments will be quoted here. They illustrate the possibility for Member States to reduce incidental catches of marine species with a poor conservation status and of Community interest, such as the sturgeon:

- Council Regulation (EC) n° 973/2001, of 14 May 2001, laying down certain technical measures for the conservation of certain stocks of highly migratory species;

- Council Regulation (EC) n°812/2004, of 26 April 2004, laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) n°88/98.

Both instruments aim at reducing catches of cetaceans during fishing activities and set up a monitoring system on board of vessels. They also provide for measures to progressively eliminate fishing gears known to carry a risk for small cetaceans and impose in some cases the use of acoustic deterrent devices.

The Common Fisheries Policy (CFP, EC n°2371/2002 of 20 December 2002) must allow an exploitation of life aquatic resources that ensures the sustainability of economic, environmental and social conditions, taking into account the impact of fishing activities on the environment. In this regard, the integration of the CPF and the Community environment policy is necessary.

On the one hand, the fact that the European sturgeon remains highly threatened in spite of its status under these international instruments reinforces the urgent need for significantly enhanced Europe-wide cooperation and action, as set out in this Action Plan. On the other hand, the instruments themselves provide important tools and mechanisms for the delivery of such actions on the ground.

3. OBJECTIVES AND MEASURES

3.1 Goal of the action plan

To ensure the conservation and restoration of the Atlantic sturgeon species, *Acipenser sturio*.

3.2 Objectives

While recognising that a range of measures has already been taken for the conservation of the European sturgeon, these have so far proved insufficient. The pressure from poaching and bycatch remains a continuous threat to the remaining individuals. They will not survive unless fishing pressure is greatly reduced. Remediation of the population will require supportive stocking activities including the onset of restocking in other watersheds than the Gironde. Therefore, migration routes and habitats for all life-cycle stages are to be protected and restored.

The logic frame of the action plan's objectives is to reduce the threats identified: on the one hand, to reduce the natural mortality and, on the other hand, to enhance reproductions and boost the size of the population.

The plan has four main objectives:

- Conservation of the species ex-situ and in-situ; i.e. prevent everything that could induce a direct mortality on the species.
- Restoration of the habitats; i.e. modify the environment of the species so that its needs are adequately met.
- Reintroduction and enhancement of the species; increase the number of individuals with release in the natural environment.
- Coordination of the implementation of the actions.

The top priority is to master the long term ex-situ stocks conservation to gain time to be able to restore their environment to reach an acceptable pressure on the European sturgeon. It's necessary to reduce its mortality rate in the natural environment so that introduced sturgeon can settle down sustainably. Currently, the mean mortality in the environment is far too high for a species with a long life cycle such as the sturgeon. Even with the release of 100 000 alevins every year during a period of 10 years in a favourable environment like the Gironde, the population would not be viable.

An international restoration plan also expects results indicators and quantified objectives. The ideal situation would be to quantify the effect of every action on the population. Unfortunately, in the case of the sturgeon, it is very difficult to monitor the population:

- First of all, the ecological data for modelling are not available. There is a lack of knowledge about the species' movements and generally about its life at sea.
- Then, it would be necessary to count the adults, which is impossible at sea. Even the records of captures during their migration in freshwater is not reliable as they ascend the river at irregular time intervals.
- Finally, an objective could be fixed linked to a historical level, such as the number of captures by fishermen. But in this case the number should be connected to progress in fishing techniques. This type of estimation is only reliable if the fishing effort is constant, and it assumes a direct involvement of fishermen.

3.3 Means to achieve the objectives

3.3.1 Conservation of the species

Conservation of this species is critical. In the first place, it involves reducing direct mortality of wild individuals due to captures, as no long-term solution can be envisaged given current mortality rates. To conserve the species is also to protect the biological capital *in situ* in order to have the

maximum genetic diversity. Finally, the conservation of the European sturgeon can be achieved through an *ex situ* precautionary reserve, in case the species disappears.

To conserve the species *Ex-Situ*					
Action	**Rationale**	**success indicator**	**Targets**	**Term**	**Resources**
Maintain the existing stocks of sturio in good conditions and prevent its "natural erosion" as much as possible	daily conservation and taking care of the fishes is a prerequisite to any action ex situ	Stocks' death rate near 0	Stocks' Managers?	Continuous up to complete restoration	
Expand the size of the stock by reproduction or catches	To carry out research that can damage fish and also to gain genetic heterogenity	numbers of fish is raised, genetic heteroginity?	Stocks' Managers?	Main effort before first reproduction (short term) continuous	
Improve the breeding knowledge in artificial conditions to developp technics for breeding farms	Breeding farms need technics	Scientific publications	CEMAGREF, IGB	Main effort before first reproduction (short term) continuous	
Create a tissue and gametes bank of the species.	Technique of last resort in case the rest of the programme fails	A sufficient quantity of material is conserved	Research institutes	Short	
Define Pre requisites for transfer of juveniles	Needed to transfert fish and create new ex-situ stocks	Pre requisites are listed and aknowledged by the workgroup	???	Short	
Increase the number of ex situ stocks sites	Secure the ex situ stocks	Four ex-situ stocks with more than 20 sturio are effective	Governments	Short to medium after first reproductions	
Action	**Rationale**	**success indicator**	**Targets**	**Term**	**Resources**
Raise the awareness among fishermen and fisheries' inspections about the status of the sturio as "protected species".	Minimise the mortality rate caused by accidental captures; clarify the obligations derived from the status of protected species.	The interest and involvement of relevant stakeholders. Fishing records.	Professional fishermen and fisheries' inspections on the distribution area.	Short and continuous	
Education Campain about the risks of exotic sturgeons' introduction	To limit the introduction of exotic sturgeon's species because of hybridation	?	All stakeholders	Medium, continuous	
Identify and treat the gaps and conflicts in the implementation of the legal framework	Stop illegal captures.	?	Maritime authorities, fishing councils and equivalent institutions.	Short to medium	

Define and share a case-by-case decision-making system concerning authorised captures for scientific purposes.	A good management of the stocks is essential. Observation *in situ* is required to learn about the behaviour of the species.	All relevant actors have adopted a common system of decision-making for the capture of individuals.	Centres for the conservation of the sturgeon: CEMAGREF and IGB	Short	
Monitor Populations	The steering committee needs feedback of the effectiveness of its actions	Report to the steering committee	Research centers	Continuous	

3.3.2 Protection of the habitat

The natural habitats of the European sturgeon generally suffer from serious structural damages. Their increasingly worsening quality can only make them unsuitable for the ecological demands of the species and jeopardize its survival. The measures to be taken under this objective aim to improve the habitat of the sturgeon in order to promote its reproductive success and, to a lesser extent, reduce its mortality. In the case of the sturgeon, the protection of its whole habitat is a difficult objective due to its large distribution area.

Protection and restoration of the habitat					
Action	**Rationale**	**success indicator**	**Targets**	**Term**	**Resources**
Identify essential habitats for sturio	this is the first step to manage habitats	A Map is presented to the steering group	Researchers and experts	short to medium	
Protect essential habitats	To prevent damage on habitats	inscription of the area in the legal framework	Governments where the fish is to be released	medium, depending on the schedule of reintroduction	
Restore needed damaged habitats	Should be done in case of reintroduction	report by experts	Governments where the fish is to be released	Depending on the schedule	
Set up a river basin management, implementing locally the water frame directive.	strategy to prevent troubles in order to ensure the quality of freshwater ecosystems	The river basin management is presented and acknowledged by the workgroup	Governments	medium to long	
Regulate those activities that could have a negative impact on the species so as to reduce their effect.	Promote the long-term survival of the population of *Acipenser sturio.*	National laws…	Governments of countries where the sturgeon is or is going to be present	continuous, depending on local schedule	
Monitor essential habitats	to ensure there is no new degradation	?? A map showing the amount of pressure is drawn and showed to steering committee	National researchers	continuous, depending on local schedule	

3.3.3 Reintroduce and enhance the species

Natural populations are not able to rebuild themselves. The only possibility of restoration for the species is through captive breeding and reintroduction in the wild. This objective constitutes the main element of the action plan for *Acipenser sturio*. Their integral reproduction cycle must be mastered in order to strengthen populations efficiently

Taking account of the long life cycle of the species, partly at sea and partly in rivers, the indicators of reproduction success are not appropriate. The best indicator would be to observe natural reproduction, which implies to wait for more than a decade. Another option would be to estimate the rate of mortality, but this presents problems in adulthood, as no reliable count can be undertaken at sea. It is necessary to discuss the indicators that can be used.

Reintroduce and enhance the species					
Action	**Rationale**	**Success indicator**	**Targets**	**Term**	**Resources**
Strengthen the current population in the Garonne and Gironde.	It is the last viable population so releases stand the best chance of success. The genetic diversity of the last wild individuals must be conserved.	Several natural reproductions take place every year	CEMAGREF and breeding farms	Short	
Realise feasibility studies of the reintroduction in the river basins where the sturgeon was historically present.	The European sturgeon has disappeared from almost every river where it was present. It is important to maximise the chance of reintroduction by selecting the most favourable rivers for reintroduction.	The studies are completed and distributed to the working group	Research centre and NGOs	Medium	
Prepare management plans for re-introduced populations	to solve potential conflicts	Report on the coordination body and steering group	NGOs and experts, Ad hoc groups	Short, Depending on the schedule	
Set up a/several breeding farm/s.	Obtain a sufficient amount of alevins and do efficient releases.	Annual production of 100.000 larvae	Countries	Medium	
Reintroduce the European sturgeon in selected sites.	As above	Several natural reproductions take place every year	breeding farms and ad hoc groups	Medium to long	

3.3.4 Coordination of the action plan

A plan of this size requires a clear and structured organisation. The number of stakeholders is central, and it is of primary importance that each of them has an overview of the project's progress.

Coordination of the actions					
Action	**Rationale**	**Success indicator**	**Targets**	**Term**	**Resources**
Create a steering committee that stand every two years	To manage the actions	On the schedule, number of meeting report	all stakeholders	Continuous	
Facilitate effective communication, share knowledge.	The number of stakeholders for this plan is high.	Feed-back to the working group	steering committee and all interesed countries	Continuous	

Increase the number of interested countries and adapt the scope of the actions	The action plan is international. The success of the project depends on the number of participating countries.	Number of countries that respond to invitation	Secretary of Bern and steering committee	Continuous	
Identify possible funding to carry out these actions	The action plan requires funding to be undertaken.	?	Countries, European Commission and private financing bodies	Short and continuous	

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